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ABSTRACT

This first volume of a two-volume report describes a project at the New Jersey Institute of Technology (NJIT) which assessed the effectiveness of a Virtual Classroom (VC) in which students and teachers communicate through a computer-mediated system called the Electronic Information Exchange System (EIES). Chapter 1 provides background on project goals, learning in the VC, educational technology and effectiveness, software, a theoretical framework, and outcomes to be measured. A discussion of methodology, covering target courses and subjects, experimental design, evaluation, measurement, and data analysis is presented in Chapter 2. The next chapter deals with implementation problems related to student recruiting, equipment, software, resistance to collaborative learning, electronic pranks, and experimental controls. Chapter 4 describes student perceptions of the VC based on pre- and post-course questionnaires. Differences in course outcomes as affected by mode of delivery (completely online, mixed, or face-to-face) are discussed in Chapter 5, while Chapter 6 looks at the effects of student attitudes, attributes, behavior, and access conditions on outcomes. Findings are summarized in the final chapter. Appendixes include: (1) the baseline questionnaire for students, with frequency distributions; (2) the post-course questionnaire for students, with frequency distributions; (3) the questionnaire for students who dropped the course, with frequency distributions; (4) the guide for interviews with students; and (5) interview transcripts. (90 references) (MES)

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Learning in a Virtual Classroom

Volume 1 of
A Virtual Classroom on EIES:
Final Evaluation Report

Starr Roxanne Hiltz

Funded by
Annenberg/CPB Project

New Jersey
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LEARNING IN A VIRTUAL CLASSROOM

Volume 1 of

A VIRTUAL CLASSROOM ON EIES: FINAL EVALUATION REPORT

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RESEARCH REPORT #25
COMPUTERIZED CONFERENCING AND COMMUNICATIONS CENTER
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This report is a result of the hard work of many people, some of whom are thanked individually in the Foreword.

EIES, TEIES, Personal TEIES and Virtual Classroom are trademarks of New Jersey Institute of Technology.

DEDICATION

In memory of my dear friends and colleagues, who cared passionately about teaching, and who are greatly missed:

Robert Wharton, 1926-1985

Rhoda Golden Freeman, 1927-1986

Glenn Halvorson, 1935-1987

Foreword and Acknowledgments

Many people who would like to attend college are unable to do so because they haven't the time or means to get to traditional classrooms on a traditional schedule. The person with a career outside the home, the person caring for small children, the disabled person - all of these individuals may find themselves shut out from furthering their education.

Other students find the traditional classroom to be boring or ineffective for them. For instance, they might like to play a more active role in discussions and projects applying the skills and ideas covered in the courses, or to have more control over the pace at which material is covered.

The Virtual Classroom, an innovative program originating at New Jersey Institute of Technology, brings the university into the homes and work places of such students through the use of computers. Specially designed computer software electronically links the Virtual Classroom student to his or her professors and classmates. Using a microcomputer, a telephone, and a device called a modem, the student attends lectures, takes tests, receives feedback from professors, attends conferences with fellow students, and more. The advantage is that the student need not adhere to a schedule of class meetings. The student decides at what time of day he or she will review a lecture, ask a professor a question, take a test, etc. Computer messages can be sent by the student and the professor at any time of the day or night.

During the second year of the project, "Tools for the Enhancement and Evaluation of a Virtual Classroom," prototypes of software tools to support online classes were implemented within

"EIES1," the Perkin-Elmer-based version of the Electronic Information Exchange System, and courses were conducted partially and totally online. In addition, during this time work progressed on PC-based software, called "Personal TEIES," which allows the integration of graphics (pictures, equations, and other symbols not present on a standard keyboard) with text. As an operational trial of a new mode of educational delivery, a variety of evaluation methods were used to assess the effectiveness of the Virtual Classroom, especially as compared with courses taught within a traditional (physical) classroom. Of particular interest was the identification of variables which were related to relatively good and relatively poor outcomes for students within this new educational environment. This report of results is divided into two parts; Volume 1 includes a project overview and results from the students' points of view, and Volume 2 presents the experiences of the instructors and a guide for effective teaching online. Volume 1 incorporates extensive material from two interim reports:

- The Virtual Classroom: Building the Foundations. Research Report 24, CCCC at NJIT, September 1986.
- Evaluating the Virtual Classroom: Revised and Updated Plan. CCCC Technical Report 87-16, March 1987.

Detailed specifications for the software appear separately:

Starr Roxanne Hiltz, Branching Capabilities in Conferences: A Manual and Functional Specifications. Technical Report 86-1, CCCC at NJIT, 1986 (Revised 1987).

B.J. Gleason, Instructional Management Tools on EIES. Technical Report 87-12, CCCC at NJIT, 1987.

John Foster, Final Design Specifications for Personal TEIES 2.0: Text and Graphics Composition System and Personal Communications Manager. Technical Report 87-15.2, CCCC at NJIT, 1987.

Heidi Harting, User Manual for Personal TEIES 1.0. Technical Report 86-4, CCCC at NJIT, 1986 (Revised 1987).

During the third year of the project, the software tools designed and implemented on EIES1 will be rewritten in the "C" language and implemented on TEIES, the Tailorable Electronic Information Exchange System. A Virtual Classroom on TEIES will operate on any IBM-VM mainframe, and will be made available for lease to interested educational institutions. Limited beta testing will be carried out, but no systematic evaluation such as reported here will be conducted, unless additional funding is secured.

In "Building the Foundations," I described my role as Principal Investigator for this project as something like that of an orchestra conductor. I had a vision of what the final product should be like. To achieve it, however, required the skill, hard work, and cooperation of hundreds of people. The project described here is the evolving creation of many people working together. If I am the conductor, then four people can be said to be playing key parts as "section leaders:" Ellen Lieberman-Schreihofer, who is Assistant Project Director for Research and Administration; John Foster, Assistant Project Director for Software Development; Steve Ehrmann, the Annenberg/CPB Project Officer who has always been available for good and timely advice; and Ron Rice, who serves as Chairperson of the Evaluation Panel. The software development team included Murray Turoff, Irina Galperin, B.J. Gleason, Tod Gordon, Heidi Harting, Sal Johar, Roland Sagolla, Sidney D'Souza, and Abdo Fathy Youssef. Research and administrative support was contributed by Bob Arms, Judith Ennis, Tanmay Kumar, B.V. Sudarshan, Cindy Thomas, and Dina Vora. George Baldwin volunteered his help in conducting intensive interviews with a small number of students. The offices of the Registrar and Public Relations at NJIT and Upsala were particularly cooperative in contributing their time to the project. Faculty members who developed and offered online courses or portions of courses and who endured the extensive demands of the evaluation procedures included Lincoln Brown, Roseann Dios, B.J. Gleason, Glenn Halvorson, Linda Harasim, Enrico Hsu, Robert Meinke, Sylvia K. Rudy, and Mary Swigonski. The full Advisory Board is listed in the Appendix, including identification of those who took on the arduous duty of serving on the Evaluation Panel; they have made many valuable suggestions which helped a great deal in setting the priorities for the project. Finally, the cooperation of the participating students is also fundamental, and I am grateful to each one who has filled out questionnaires, sent a bug report, or shared an idea for improvement in procedures.

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EXECUTIVE SUMMARY
A VIRTUAL CLASSROOM ON EIES
FINAL EVALUATION REPORT

The Virtual Classroom [TM] is a system for learning and communicating via connected computers. Students in the Virtual Classroom share their thoughts, questions and reactions with professors and classmates using computers equipped with specially designed software. The software enables students to send and receive messages, interact with professors and classmates, read and comment on lecture material, take tests and receive feedback, and more, without having to attend scheduled classes. Learning can take place at any location in the world and at any time of the day using a computer on campus, at home or in the workplace.

The primary goal of the project is to demonstrate that it is possible to use computer-mediated communication systems to improve access to, and the effectiveness of, post-secondary educational delivery. The most important "product" of the project is knowledge about the advantages and disadvantages of this new technology. The two key research questions that arise are:

> Is the Virtual Classroom a viable option for educational delivery? That is, are outcomes, on the whole, at least as good as outcomes from face-to-face, traditional classroom courses?
>
> What variables are associated with especially good and especially poor outcomes in this new teaching and learning environment?

During the past two years, with major funding from the Annenberg/CPB Project, New Jersey Institute of Technology has constructed a prototypical Virtual Classroom, offering many courses fully or partially online. Students and professors, using personal computers, communicate with each other through a larger, centralized computer running a computer-mediated communication system called EIES

(Electronic Information Exchange System), that was enhanced with special software to support educational delivery. EIES runs specifically on a Perkin-Elmer Corporation computer which resides at NJIT. However by the fall of 1988, an IBM mainframe version of the Virtual Classroom will be made available for lease.

The final evaluation report summarized here includes a description of the software developed and of the quasi-experimental research design used to assess its effectiveness as compared to traditional classrooms. The first volume of the report focusses on the results for students, while the second volume presents the accumulated wisdom of the faculty members who took part in the experiment.

SUMMARY OF VOLUME I

Software Innovations

Conceptually, we divided these into three types:

- "Branch Activities" can be attached to a class conference in order to support special types of assignments, or delivery of material for activities that involve the whole class. An "activity" is an executable program rather than ordinary text. For example, initial activity types include reading of long documents, examinations, conditional question and response delivery, compiling and running Pascal or Fortran programs, and selection of choices from a list.

- Support tools help the instructor manage assignments, grading and quizzes for individual students. Instructional management tools include an electronic gradebook and routines to collect and track the submission of assignments.

- Personal TEIES [TM] is microcomputer-based software which integrates the composition and display of graphic elements mixed with text, and manages the uploading and downloading of material. It provides a blackboard-like facility for the Virtual Classroom.

Collaborative Learning Strategies

Computer-Mediated Communication is particularly suited to the implementation of collaborative learning strategies or approaches. Collaborative learning means that both teachers and learners are active participants in the learning process. In this environment, knowledge is not something that is "delivered" to students, but rather something that emerges from active dialogue among those who seek to understand and apply concepts and techniques. All courses in this project attempted to include collaborative learning elements.

Research Methods

In order to explore our key research questions, we observed a variety of courses, students, and implementation environments. The primary research design is based on matching but "non-equivalent" sections of the same course taught in the Virtual Classroom (VC) and in the Traditional physical Classroom (TC). Though the same teacher, text and other printed materials, and midterm and final exams were used, the classes were "non-equivalent" because the students were able to select the delivery mode. The matching courses included Introductory Sociology at Upsala College, freshman-level Computer-Assisted Statistics at Upsala, Introduction to Computer Science at NJIT, and an upper-level course in statistics at NJIT. The two colleges provided very different implementation environments. Upsala is a small liberal arts-oriented college with one microcomputer laboratory and little prior integration of computing into the curriculum. NJIT is a technological university where for the last three years incoming freshmen have been issued IBM-PC compatible microcomputers to take home, and where computers are used in all freshman-level courses.

In the study several other courses and sections were included in order to increase the number of subjects and the generalizability of the findings. Three online courses were repeated in order to allow the instructors to try to improve them, based on experience. Some other courses were taught through a combination of online and traditional approaches (mixed mode). One of these mixed mode courses was NJIT's management course for majors in other fields (OSS 471), which had one section that conducted its management laboratory exercises in the traditional manner (offline), and one which used the VC as a "Virtual Laboratory." Other courses which used VC in a mixed or adjunct mode included Organizational Communication, a Freshman Writing Seminar, an Anthropology course on North American Indians, and a course in Business French (all at Upsala).

The project also included some data collection on courses offered online to distance education students by other institutions: the media studies program offered by the New School through Connected Education on EIES and a graduate-level course offered by the Ontario Institute on the PARTIcipate system. In all, data were collected from a total of 150 students in completely online courses, 111 in mixed-mode courses, and 121 in traditional or "control" courses.

Most of the data used in the study were collected through pre-and post-course questionnaires. However, we also gathered behavioral data (including grades, when appropriate or available, and amount and type of online activity) and qualitative observations and interviews.

Implementation Problems

The implementation of the prototype Virtual Classroom was far from optimal. Problems included:

.Insufficient recruitment of students for the experimental online sections.

.Opposition from faculty members who believed that the medium would fail to adequately deliver college-level courses and/or that it would be unfair competition, causing decreased enrollments in their courses.

.Failure to adequately inform all students enrolled in the experimental sections concerning the nature of the educational experience in which they would be involved (despite explanations in registration material, campus newspaper articles, flyers and posters).

- .Inadequate amounts and quality of equipment for student access, especially at Upsala.
- .Limited capacity of the central host (EIES), which was sometimes saturated, resulting in slow response or busy signals.
- .Unfinished software tools to support the Virtual Classroom, including the graphics package that had been considered vital to some of the courses.
- .Resistance by some students to collaborative learning.
- .Deliberate student misbehavior.
- .Impossibility of rigid experimental control which "holds everything constant" except the medium of course delivery.

These problems interacted. For instance, we had initially anticipated only four courses involved in the experiment. Many other courses were later added to the study, due in part to the low enrollment in the experimental sections. Each additional course had its own unique problems and demands, increasing the overload on the project's limited staff. It would have been more effective to implement the project over a longer time period. Though some of the implementation difficulties were due to the pioneer nature of this effort, the first implementation on any campus is likely to encounter similar difficulties. Thus, other colleges and universities are advised to start small. Select one or two courses for the initial efforts. The staff who gain experience can become the coaches for subsequent expanded programs.

Impacts on Students

Despite implementation problems, the outcomes of this field experiment are generally positive, supporting the conclusion that the Virtual Classroom mode of delivery can increase access to, and the effectiveness of, college-level education.

The results of statistical analysis of data relating to the major hypotheses concerning outcomes are listed below. Initially, there was a separate hypothesis that the mixed-mode results would not simply represent an "average" of the Virtual Classroom and Traditional Classroom modes, but might have some unique advantages and disadvantages. In the following summary, results related to this speculation are included in reviewing each of the other hypotheses.

Hypothesis 1: There will be no significant differences in scores measuring MASTERY of material taught in the Virtual and Traditional Classrooms.

Finding: No consistent differences. In one of five courses, VC final grades were significantly higher.

This hypothesis was tested using a quasi-experimental design which compared the midterm exam scores, final exam scores, and final grades attained by students in matching sections of five courses. In Computer Science, student performance tended to be significantly better, on the average, as measured by grades. Though there are no statistically significant differences for the two freshman level courses in Sociology and Statistics, these were courses in which many students did D or F work in both modes, and the instructors tended to feel that the mode further disadvantaged young, poorly motivated students with marginal levels of reading, writing and quantitative skills.

Hypothesis 2: VC students will perceive it to be superior to the TC on a number of dimensions:

2.1 CONVENIENT ACCESS to educational experiences (supported): Students rated the VC as more convenient than the TC.

2.2 Increased PARTICIPATION in a course (supported).

2.3 Improved ability to apply the material of the course in new contexts and EXPRESS their own IDEAS relating to the material.

Finding: Increased confidence in expressing ideas was most likely to occur in the mixed modes courses.

2.4 Improved ACCESS to their PROFESSOR (supported).

2.5 Increased level of INTEREST in the subject matter, which may carry beyond the end of the course.

Finding: This is course-dependent. Though the averages for measures of increased interest are higher for both the VC and mixed modes, the overall scores are not significantly different. Interest Index scores are highest for the VC mode at NJIT and for the mixed -mode courses at Upsala.

2.6 Improved ability to SYNTHESIZE or "see connection among diverse ideas and information."

Finding: No significant differences overall; mode interacts with course.

2.7 COMPUTER COMFORT: improved attitudes toward the use of computers and greater knowledge of the use of computers (supported).

2.8 Increased levels of communication and cooperation with other students in doing coursework (Group COLLABORATION).

Findings: Mixed and course-dependent. For example, although 47% of all students in VC and mixed-modes courses felt that they had communicated more with other students than in traditional courses, 33% disagreed. The extent of collaborative learning was highest in the mixed-mode courses.

2.9 Improved Overall QUALITY, whereby the student assesses the experience as being "better" than the TC in some way, involving learning more on the whole or getting more out of the course (supported).

Though the average results supported most of the above predictions, there was a great deal of variation, particularly among courses. Generally, the above outcomes were dependent more on variations among courses than on variations among modes of delivery. The totally online upper level courses at NJIT, the courses offered to remote students, and the mixed-mode courses were most likely to be perceived by the the students as "better".

Hypothesis 3: Those students who experience collaborative learning in the Virtual Classroom are most likely to judge the outcomes of online courses to be superior to the outcomes of traditional courses.

Finding: Supported by both correlational analysis of survey data and qualitative data from individual interviews. Those students who experienced high levels of communication with other students and/or with the professor were most likely to judge the outcomes of VC courses to be superior to those of TC courses.

Outcomes are Related to Student Characteristics In many cases, results of the quantitative analysis are inconclusive in determining which is "better," the VC mode or the TC mode. The overall answer is, "it depends." Reported outcomes related to Hypothesis 2 above are superior for well-motivated and well-prepared students who: have adequate access to the necessary equipment; take advantage of the opportunities provided for increased interaction with the professor and other students; and actively participate in a course. Students lacking the necessary basic skills and self-discipline will do better in a traditionally delivered course. Critical to whether or not the VC mode is "better" is the extent to which the instructor is able to build and sustain a cooperative, collaborative learning group. It must be noted that it takes new types of skills to teach in this new way.

The VC is not without its disadvantages, and it is not the preferred mode for all students (let alone all faculty). Students (and faculty) report that they have to spend more time on a course taught in this mode than they do on traditional courses. Students also find it more demanding, since they are asked to play an active part in the work of the class on a daily basis, rather than just passively taking notes once or twice a week. For students who want to do as little work as possible in a course, the Virtual Classroom tends to be perceived as an imposition rather than an opportunity.

TEACHING EFFECTIVELY ONLINE: A SUMMARY OF VOLUME II

Getting Started

In order for students to participate effectively in the Virtual

Classroom, they must have adequate access to the system, feel comfortable with the medium and with each other, and know what is expected of them. To create these conditions, the instructor must be competent in using the system and have a course design worked out ahead of time, one appropriate to the medium and the capabilities of the specific system and students. Before trying to teach an entire course online, it is a good idea for an instructor to observe and participate in conferences conducted by others, and to practice using the editor and the advanced features of the software that will be used. It is preferable for a faculty member to begin teaching in the Virtual Classroom by conducting a mixed-modes (part VC and part TC) course. Faculty feel that, with practice, they gain a great deal of skill in teaching this way and that the amount of time and effort required decreases dramatically with experience.

Teaching Techniques

Responsiveness to the students is the single most important attribute of an effective online teacher. This requires daily attention (about 30-60 minutes a day). The instructor must act as a discussion leader and stimulator of active participation, and as a coordinator of and advisor for collaborative learning activities. The instructor must also establish procedures by which individuals can organize and monitor the heavy flow of material that occurs in a successful VC.

Mixed-Media Courses

It is assumed that all VC-based courses are multi-media in the sense that text books, readings and other print-based materials are used by students. Lengthy materials available in print should be distributed that way, not put into a computer system to be read on a CRT.

However, the VC can be used to supplement courses delivered primarily face-to-face or via distance education modes such as audio and video. For example, it has been used to:

- Serve as a "Bulletin Board" where updated information on assignments or exams is posted for students to check between classes.
- Act as "electronic office hours" for student communication with the instructor.
- Serve as a medium for students to submit assignments and receive feedback. In some cases, this has extended to thesis advisement or independent study guidance.
- Conduct public tutorials. Questions and answers from students are posted for all to see, on the assumption that if one student has a problem with a subject covered in class or in the text, other students may be encountering the same difficulty.
- Facilitate group projects, providing a working environment without having to meet at the same time and place.

For such adjunct use of VC to be successful, students must see the online segment of activity as important enough to motivate them to use the system frequently and participate actively. In some distance education courses, students have been encouraged, when needed, to get online and send questions to their instructor. If this was entirely optional and other students were not informed of, or responsible for, issues discussed in these exchanges, few students bothered to sign online at all.

When using VC in an adjunct mode, the instructor must stress that it is a course requirement. It must be stated clearly that grades will be related to the amount and quality of students' online activity-- undergraduates seem to respond primarily to this motivator ("Will it be on the test?"). Online activities should be spread evenly throughout the course, as opposed to a few scattered assignments so far apart that students never get in the habit of signing on at least twice a week, and forget how to use the system between sessions. Generally, a course that is approximately half online and half via other modes is a good mix.

Finally just as with a totally online course, use the medium frequently, not just for one-to-one communication between teacher and student, but as a tool for group collaboration and activity. This extends and enhances the course activities that occur through other media.

CONCLUSIONS

The Virtual Classroom is a viable delivery option for post-secondary education. On the average, outcomes are at least as good as outcomes for traditional courses, while access to educational opportunities is improved. The average student who participated in this experiment reported an improvement in both the access to, and the quality of, the educational experience.

However, improved outcomes are contingent upon providing adequate access to equipment, faculty effort and skill in teaching with this new tool, and student characteristics. Students who are motivated, self-disciplined, and possess average or better quantitative and verbal skills (as measured by tests such as the SAT) are likely to experience superior outcomes, as compared to traditional courses. Students who lack motivation and basic college level skills, or who must travel to use a computer terminal for access, are more likely to drop out of an online course, to participate more irregularly, and to perform more poorly than in a traditional course.

CHAPTER 1: INTRODUCTION AND OVERVIEW

Perhaps a scenario is the next best thing to "being there" for understanding what a "Virtual Classroom" system is like. Picture a snowy Saturday afternoon in early December. Jenny Smith pours herself a mug of coffee, turns down the volume on "Twisted Sister" slightly, and decides to "go to class." She powers up her Personal Computer, presses the key for auto-dial, and she's there.

The first thing Jenny does is check her waiting messages. Her professor has graded the Fortran assignment she turned in online two days ago and commented on it ("A careless error in line 34, Jenny. Also take a look at Bob's assignment for a somewhat more elegant solution. Grade: 85"). Then she checks the gradebook to see what her average now is: 88, she's going to have to do a really solid A on the final exam to get an A in the course. Then Jenny joins the class conference. She picks out the "branch" where assignments are deposited. There's a special program that allows you to look at the other students' assignments only after yours is completed too. She finds Bob's program, and lists it. Hmmm... yes, that was a better way to handle that part of the problem.

Last night, she had read the assigned textbook chapter for the last unit of the course. She notes the last lecture is in the class conference, and downloads it to her PC. Later, she will print it and read it carefully, using a highlighter to mark the parts she will want to review before the final.

An informal "one-liner" appears on her screen: "Hi Jen-- Wanna chat?" (Her account is set to allow others to interrupt with "real time" messages).

"Hi Sam-- not unless you provide a virtual fireplace and some marshmallows," she types back.

Jenny spends about 20 minutes reading the latest comments by other students in the debate about artificial intelligence. (Is it possible? What is it? Is it good or bad?) She adds a comment of her own, then decides to check into the "cafe" before leaving, where there is a discussion going on about surrogate motherhood. That's not part of the course, but sort of an "extra-curricular activity," like going to the school pub, that students and professors from many courses can join. Later tonight, when she has studied the lecture, she will sign on again and take the weekly quiz. Jenny works full time, and tries to do most of her work for the course on the weekends.

*****

A "Virtual Classroom" can be defined as a teaching and learning environment located within a Computer-Mediated Communication System (CMCS). Rather than being built of bricks and boards and metal, it consists of a set of communication and work "spaces" and facilities constructed in software. In order to be considered a "Virtual Classroom," the system must support all or most of the types of communication and learning activities available in the "traditional" (physical) classroom and campus. There should be an interaction space like a classroom where the "teacher" or others may "lecture" and where group discussions may take place; a communication structure like "office hours" where student and teacher may communicate privately; the ability to administer, collect and grade tests or assignments; and the ability to divide a larger class into smaller working or peer groups for collaborative assignments. Ideally, there should also be the equivalent of a "blackboard" where diagrams or equations may be posted for discussion or note-taking.

One difference between the two learning environments is that in the Traditional Classroom (TC), most interaction takes place by speaking and listening (though it may be supplemented by writing and reading from a blackboard or from "handouts.") In the Virtual Classroom (VC), interaction takes place almost entirely by typing and reading from a computer terminal (though it includes the use of print materials such as textbooks, and may be supplemented by an occasional face-to-face meeting or telephone call). Because it is located within a CMCS, interaction among teacher and students in the Virtual Classroom is also asynchronous, with the computer storing waiting communications for each participant.

Using the analogy of software structures to emulate interactional forms in the traditional classroom gives the unfortunate impression that the VC can never be more than a second-best simulation of a TC. On the contrary, a collaborative learning environment that is computer-mediated can support some types of activities that are difficult or impossible to conduct in face-to-face environments, particularly if there is a large class. In addition, discussion and communication about the course becomes a continuous activity, rather than being limited to a short scheduled time once or twice a week. Whenever a student has an idea or question, it can be communicated, while it is "fresh."

Both face-to-face and CMC as modes of communication have strengths and shortcomings (See Hiltz, 1986a). The relative effectiveness of a VC is contingent on the teacher conducting the course in a manner which fits the characteristics of the medium, the nature of the course materials, and the characteristics of the students. It depends on whether or not teachers and students take advantage of its potential to support an active learning process that incorporates extensive interaction among students and between instructor and students (Hiltz, 1986b). It also requires adequate access to the necessary equipment (PC's and modems), so that the students may easily access the facility. The basic premise of this project is that given the right software tools and depending on these contingencies, the VC can actually be a more effective mode of delivery for post-secondary education than the TC.

At least equally important as comparisons to face-to-face delivery modes would be comparisons to non-interactive forms of distance learning, such as the correspondence course or a television-based course. Such comparisons were not included in this study, and are an important focus for future research. For instance, one might compare the same course delivered via television broadcast, conducted totally via the Virtual Classroom approach, or offered in a mixed modes format which combined T.V. broadcasts with online discussion and assignment submission.

This document describes the goals of the Virtual Classroom project, its implementation and use in a prototype form, the theoretical framework which guided the implementation, the evaluation methods, and the results. The primary goal of the evaluation was to determine the exchangeability of the outcomes of student experiences in the Virtual Classroom with those in the traditional classroom; and to identify characteristics of students and of online interaction which were associated with the most successful outcomes for the VC environment. Particular emphasis was placed upon the extent to which educational processes in the Virtual Classroom facilitate collaborative or peer group learning, whereby students learn through communication with one another. In addition, attention was paid to capturing and documenting implementation problems.

In order to explore these questions, it was necessary to observe a variety of courses, students, and implementation environments. The primary research design rested upon matched but "non-equivalent" sections of the same course taught online and in the traditional classroom. Though the same teacher, text and other printed materials, and midterm and final exams were used, the classes were "non-equivalent" because the students were able to self-select delivery mode. The matched courses included Introductory Sociology at Upsala College (Soc 150); freshman-level Computer-Assisted Statistics at Upsala (CC140y); Introduction to Computer Science (CIS213) at NJIT; and an upper-level introductory course in statistics for engineers at NJIT (Math 305, Statistics for Technology). The latter three courses were repeated online in the Spring of 1987, in order to allow the instructors to improve their online courses, based on their experiences the first time, and to increase the number of subjects in the study.

The two colleges provided very different implementation environments. Upsala is a small liberal arts-oriented college with one microcomputer laboratory and little prior integration of computing into the curriculum. NJIT is a technological university where for the last two years, incoming freshmen have been issued IBM-PC compatible microcomputers to take home, and computers are used in all freshman-level courses.

In addition, some courses were taught with mixed modes of delivery (partially online and partially face-to-face). This included the extensive laboratory component of NJIT's introductory management course (OSS 471), which had for two semesters one section that conducted its management laboratory exercises in the traditional manner (offline), and one which used the VC as a "Virtual

Laboratory." Other courses which used VC in a mixed or adjunct mode included Organizational Communication, a Freshman Writing Seminar, an Anthropology course on North American Indians, and a course in Business French (all at Upsala). The project also included some data collection on courses offered online to distance education students by other institutions: the media studies program offered by the New School through Connected Education on EIES, and a graduate-level course offered by the Ontario Institute on the PARTIcipate system.

Most of the data used in the study were collected with a pre and post-course questionnaire. In addition, we also have more "objective" or behavioral data, including grades (when appropriate or available), and amount and type of online activity; plus qualitative observations and interviews.

The sections which follow provide the background for the remainder of this report. They describe the project goals; summarize some related studies on teaching methods and the measurement of educational outcomes; summarize characteristics of CMC that may be related to its use as a mode of educational delivery; describe the software tools that were developed to enhance CMC for educational delivery; and present the theoretical framework and hypotheses that guided the study.

PROJECT AND EVALUATION GOALS

The goal of the "Virtual Classroom" is to improve access to and the effectiveness of post-secondary education.

As Ehrmann (1988, p. 2) points out,

> Access is a problem for virtually all students. The most severe access problems are faced by people who, for reasons of location, job, handicap, economic or cultural or linguistic disadvantage, age, or other factors cannot enroll in a degree program. But access problems also impede students who are enrolled. Part-time or full-time jobs may make it difficult to attend the particular classes these students most need. They may have time for study, but not when other students are available for a study group. Sometimes the instructional resources they find may be suitable for the average learner, but not for their exceptionally high abilities or their unusually weak preparation.

"Access" in this broad sense my be improved by the Virtual Classroom in the following ways:

- Students may take any course from any instructor from any institution in the world which is offering courses in this mode. Thus, they are not limited to courses and degree programs offered in their geographic locality.
- Students may participate at any time of the day or night that they have the time and the inclination. Opportunities for feedback from the instructor and interaction with other students are not limited to a few fixed times per week.
- Students for whom travel is difficult may work from the relative comfort and convenience of their homes. This might include the handicapped, the aged, or those who must be at home as much as possible to care for children or other dependents.
- For non-resident students, the time normally spent commuting to and from campus (and finding a parking space) can instead be devoted to coursework.
- The technology makes it easy to exchange information that is difficult to share or disseminate in the traditional classroom. For example, a program as well as the output from a run may be passed back and forth among students or between student and instructor, for discussion of problems or bugs. They may be given the privilege of looking at the drafts or completed assignments of other students, in order to comment, compare, or offer constructive criticism. CMC also allows all students an equal opportunity to ask questions and make comments, even if they have difficulty in putting their ideas into words quickly. They may take as long as they need to formulate their questions

and contributions.

However, it must also be recognized that, at least when used as the sole means of educational delivery, access may be limited in the following ways:

- Currently, only a few institutions offer a few courses online. If a student wishes to complete an entire degree program online, the choice of courses is severely limited at present.
- Students who do not have a microcomputer and a modem at home or at work will have to travel to use the necessary equipment, and will be disadvantaged relative to those who do have the equipment which makes access convenient. This is likely to be related to socio-economic status, since the poor are not likely to own microcomputers, modems, etc., or to have jobs which provide them with such equipment.

However, lack of equipment need not be related to ability to pay. For instance, NJIT provides a microcomputer to all Freshmen and transfers who register, which is theirs to use for the four years that they are a student. Since the cost is "built into" the tuition, it is state-subsidized, and anyone with financial need may receive assistance which in effect pays for their use of the computer as an educational tool.

- Lack of instantaneous feedback. In the face-to-face classroom, as soon as a question is asked, the answer may be received. In this asynchronous medium, it may be hours or as long as a day until an answer is received. Moreover, the teacher might be more likely not to answer at all, or to send a "group answer" to several related messages, which does not deal adequately with each one.

Immediate feedback is possible with this medium, if the participants are online at the same time. Students working together may arrange to be online at the same time, so that they can pass drafts back and forth and engage in near-instantaneous exchanges of remarks. Students may also work side-by-side in a laboratory setting, talking about and pointing to things on their screens. However, these are the exception. Most of the time, communication will be asynchronous, with answers to questions delayed.

.Students with poor reading and writing skills may have their effective access lessened, since the only means of communication is based on writing (typing) and reading.

.Lack of skill using a microcomputer, and software bugs or hardware "crashes," might severely hamper timely exchange of communication.

Effectiveness is defined in terms of the extent to which a course achieves a set of learning goals for the learner. Effectiveness may be improved in the following ways:

.Facilitation of "collaborative" or "group" learning in a peer-support and exchange environment. Since students may "work together" asynchonously, they can do joint projects or collaborate in other ways even though their schedules make it difficult to work at the same time.

.More "active" learning than in the traditional classroom. The computer forces responses and attention from the participants. They cannot just sit there passively and "tune out;" they must keep doing things in order to move through the materials and activities of the course. The active participation of each student may be "forced" by the software used, which may, for instance, require each student to enter answers to a question or assignment before they can move on to another activity.

.Facilitation of "self-pacing," that is, learning at a rate adjusted by the receiver rather than by the "sender." The student controls the pace; he or she may read as slowly or as quickly as is comfortable; may answer immediately or take a long time to think over a question or assignment before submitting a response. "Remedial" or "enrichment" modules or activities may be provided for those who are need more background or are capable of proceeding further than the average members of the class, and the "average student" may choose not to receive these optional materials.

An example of self-pacing was noted during the pilot phase of this project. Students whose native language was not English spent more time online than those whose language was English. Having taken longer to read and re-read materials, however, their level of contribution and was equal to that of students for whom English was the native language.

.The use of other computer resources (such as running a Fortran or Pascal program, simulations, or statistical analysis routines) may be "built into" the Virtual Classroom. Thus, students who could not afford to buy all this software themselves may have shared access to computer-based tools useful in their coursework. More importantly, as noted above, teacher and learner may look at one another's input or output from software embedded in a CMC, for example, exhanging LOTUS spreadsheets and programs, or exchanging code and outputs for Pascal programs.

.Complete notes are an automatic byproduct of the process. These are searchable and manipulatable in various ways. Thus, the student does not have to choose between active participation and having a record of the class, as he or she often must do in a face-to-face lecture/discussion.

Evaluation of this project was both "formative" and "summative." As a formative evaluation, observational and questionnaire based data were used to obtain feedback on specific subsystems and features designed to support the educational process, in order to improve the functionality and ease of use of the final software designs. As a summative evaluation, the goals are to explore the following questions:

1> What are the most effective teaching and learning processes in the Virtual Classroom (VC)? How do differences in process relate to differences in outcome, in online vs. traditional classrooms (TC)? For example, do students take a more active role online? Do they communicate less or more with other students? Included will be measures of amount and type of activity level by students and faculty.

2> What are the advantages and disadvantages of this mode of delivery for attaining specific educational goals, as compared to traditional classes? How do these vary with characteristics of the subject matter, teaching or presentational techniques, student characteristics, and access to and type of equipment used?

3> Are the overall outcomes for VC and TC essentially exchangeable, or is one mode clearly superior to the other? Are the two modes so different that it is not possible to say one is better than the other, just that they are very different? For example, when differences in student ability or motivation are taken into account, are outcomes such as exam scores essentially comparable? How do outcome measures for classes using single modes of student-teacher interaction (e.g., face-to-face or online) compare to "mixed modes" courses using a combination of delivery media? Is this related to differences in types of subject matter or student characteristics?

4> Given the above findings, what implementation techniques and what applications are recommended for future use of this technology?

Note that the first two goals listed have to do with what would statistically be termed "within group" variance, as compared to "between group" variance. That is, we expect a wide range of variability in observed and self-reported outcomes for students in the Virtual Classroom setting. In terms of priorities, we were most interested in describing and/or explaining the variables which seem to be associated with especially good and especially poor outcomes in this new teaching and learning environment.

The third goal is to identify the "average" outcomes for three modes of course delivery (VC, TC, and mixed) and to determine if there are any significant differences among them.

This is an initial experiment with a limited number of subjects. Thus, we do not expect to be able to provide definitive answers to the above questions. The evaluation research is exploratory, aimed at identifying the most important variables associated with differences in course outcomes, particularly the interaction among student characteristics, teacher behavior, and mode of delivery. Further research with a larger number of students, with a wider range of courses and software variations, and with variations in the extent and strategy for employing the Virtual Classroom approach in courses, will be necessary to establish more precise estimates of "causes" and "effects" in this new educational environment.

LEARNING IN THE VIRTUAL CLASSROOM

"Education is the structuring of a situation in ways that help students change, through learning, in intentional (and sometimes unintentional) ways." (Johnson and Johnson, 1975, p. 2) The instructor who uses a Virtual Classroom employs computer-mediated communication to create and structure the learning situation. Students who take courses in a "Virtual Classroom" are expected to learn the course material in a variety of ways. Much of the learning of concepts and skills should occur independently, from reading texts or assigned articles, listening to audiotapes, and/or using other computer tools such as Computer Assisted Learning software on a PC or mainframe software to run large programs.

In the class conference, the instructor presents supplementary "electures" (electronic lectures) and leads a discussion. Here, the students must put what they have learned into their own words, answering questions about the material raised by the instructor and responding to the contributions of other students.

Attached to the conference may also be various computer-mediated "activities" to be performed by students. For instance, there may be a quiz to take, or a computer program to write, compile, and run. Such activities are actually programs, rather than text, which are triggered to run when the student chooses to "do" the activity. This concept of activities, above and beyond the exchange of text, is one of the key software innovations of the Virtual Classroom project.

For individual questions, the student may communicate with the instructor or other students by private message. For individual or team writing or laboratory assignments, an online notebook may be used to create and edit material, with the results being shared with the instructor and/or other students in the class.

The Virtual Classroom also offers some special opportunities, including:

- Interaction and feedback may occur on a daily basis, rather than being available only during a few scheduled hours during the week.
- Pen names may be used in contributing responses to questions or assignments. This may enable the student to share ideas and experiences without embarrassment or revealing confidences. For instance, in a Sociology course, students used pen names in applying concepts of different types of socialization to their own childhood, and in applying concepts about factors related to interpersonal attraction to one of their own relationships.
- Students may learn by taking the role of teacher, being responsible for summarizing the important points of a topic or "outside reading" for the benefit of the rest of the class.
- Students may be forced to think and respond for themselves rather than passively listening to the instructor or other students. For instance, in one variety of the "response branch" activity designed for this project, students must independently answer a question before they can see the answers of the other students.
- Putting questions and answers into a written form may aid comprehension for some students. It may also improve their writing skills.

The specific types of learning activities online vary a great deal from course to course, depending on the subject matter and the skills and preferences of the teacher. Included in the Appendix to Volume 2 of this report is a narrative description of the classes which used the "Virtual Classroom" during the 1986-87 year. These were prepared by the instructors in response to a list of issues and topics to be covered, and explicitly include "lessons learned" about effective and ineffective procedures and assignments.

EDUCATIONAL TECHNOLOGY AND EDUCATIONAL EFFECTIVENESS

There is extensive literature on the effects of medium of communication on learning; on educational innovations in general; and on the instructional uses of computers in particular. In addition, there are many publications in the area of computer-mediated communication, and a few on the use of computer-mediated communication to support educational delivery. Each of these areas of previous research has relevance for predicting problems, opportunities, and effects in implementing a "Virtual Classroom."

Communication Medium and Educational Outcomes

Previous studies of courses delivered by television or other non-computer media tend to indicate "no difference" in basic outcomes. For instance, Schramm (1977, p. 28) states that

> Overall, there is no basis in the research for saying that students learn more or less from television than from classroom teaching. This does not mean that under some conditions of teaching some students do not learn more of a certain subject matter or skills from one medium or channel of teaching than from the other. But the results of the broad comparisons say that there is, in general, no significant difference.

Each medium of communication has its advantages and disadvantages. Outcomes seem to be related more to the particular implementation of an educational use of a medium than to intrinsic characteristics of a medium. Implementations which capitalize on the strengths of a medium, and which circumvent or adjust for its limitations, can be expected to be successful in terms of outcomes, while other implementations will be relative failures. Certainly, we know that some courses offered in the traditional classroom are more successful than others, and that this can be related to variations in the teaching skill and style of the instructor. Thus, it is not that "media do not make a difference," but other factors may be more important than or interact with communication medium in affecting educational outcomes for students. A primary goal in studying a new medium of communication for educational delivery must be the identification of effective and ineffective ways of using it. Clark and Salomon (1986, p. 10) summarize this lesson on past research on the instructional impact of new media as follows:

> Even in the few cases where dramatic changes in achievement or ability were found to result from the introduction of a medium such as television... it was not the medium per se which caused the change but rather the curricular reform which its introduction enabled.

The "curricular reforms" which the Virtual Classroom approach may enable are greater utilization of "active learning" and of "group learning."

The Computer and Active Learning

Development of the computer as an aid in the educational process has thus far focused on Computer-Assisted Instruction (CAI). In CAI, the student is communicating with a program in the computer which may provide a tutorial, drill-and-practice, or simulation and modelling exercises. At least for certain types of students and instructional goals, computer-assisted instruction (CAI) can be more effective than traditional methods alone. In their comprehensive review of CAI, Chambers and Sprecher (1980) conclude that it has many advantages when used in an "adjunct" or supplementary mode within a regular classroom, with class discussion following. Learners are forced to be actively involved in the learning process, and each may proceed at their own pace. Feedback tailored to each individual student provides the kind of reinforcement that will aid learning. However, when used as the sole or "primary" mode of instruction for distance learning, it appears to be effective only if there is also "significant" communication between teacher and student: "Primary CAI, and distance learning in general, may achieve results similar to those for adjunct CAI as long as there is sufficient human interaction accompanying the use of the CAI materials" (Ibid., p. 336).

Bork (1981) has been prominent among those who have emphasized the possible use of the computer as a "responsive learning environment." Creating an "active learning situation" (Bork, 1985) is the prime consideration in computer applications to education, from this point of view. The "drill-and-practice" CAI approach has been a limiting and negative influence upon developing the educational potentials of the personal computer. Too often, people using computers "tend to transpose books and lectures, and so they miss the component of active learning which is so important" (Bork, 1985).

Instructional Strategies: The Concept of Collaborative Learning

CMC is particularly suited to the implementation of collaborative learning strategies or approaches. Literally, to collaborate means to work together (co-labor). Collaborative learning means that both teachers and learners are active participants in the learning process; knowledge is not something that is "delivered" to students in this process, but rather something that emerges from active dialogue among those who seek to understand and apply concepts and techniques. In the collaborative learning model,

> Education does not consist merely of "pouring" facts from the teacher to the students as though they were glasses to be filled with some form of intellectual orange juice. Knowledge is an interactive process, not an accumulation of Trivial Pursuit answers; education at its best develops the students' abilities to learn for themselves... Another way to say this is that collaboration results in a level of knowledge within the group that is greater than the sum of the knowledge of the individual participants. Collaborative activities lead to emergent knowledge, which is the result of interaction between (not summation of) the understandings of those who contribute to its

formation (Whipple, 1987, p. 5).

Johnson and Johnson (1975) use the term "goal structure" to refer to the pedagogical strategy or structuring of relationships among students that is used in a course. We are reserving the term "goals" to refer to the desired outcomes, and in the quotations below, have changed their term "goal" to "strategy."

> Instruction can be defined as the process of arranging the learning situation in such a way that student learning is facilitated... Our theory of instruction states that successful instruction depends upon the following components:
>
> 1. Specifying desired outcomes for the students and setting appropriate instructional goals.
> 2. Implementing the appropriate [strategy... Strategies] can be cooperative, competitive, or individualistic.
> 3. Assembling the instructional materials and resources needed to facilitate the desired learning.
> 4. Creating an instructional climate that facilitates the type of interaction among students and between students and teacher needed to achieve the instructional goals. (Johnson and Johnson, 1975, p. 3).

> A [strategy] specifies the type of interdependence existing among students. It specifies the ways in which students will relate to each other and to the teacher in the accomplishment of instructional goals. There are three types of [strategies]: cooperative, competitive, and individualistic... A cooperative goal structure exists when students perceive that that can obtain their goal if, and only if, the other students with whom they are linked can obtain their goal... A competitive goal structure exists when students perceive that they can obtain their goal if, and only if, the other students with whom they are linked fail to obtain their goal... An individualistic goal structure exists when the achievement of the goal by one student is unrelated to the achievement of the goal by other students... Usually there is no student interaction in an individualistic situation, since each student seeks the outcome that is best for himself regardless of whether or not other students achieve their goals. (Ibid, p. 7)

Most distance learning has taken place using an individualistic or self-study strategy. With a totally individualistic learning strategy, CMC might speed up and increase feedback between the individual student and the teacher, but other students would not be involved in interactions related to the course material. A competitive strategy might be implemented using CMC to help to provide motivation and a reference group for students, so that they could see how they were doing in comparison to other members of the class. However, computer-mediated communication is especially well suited to collaborative or "cooperative" learning strategies. This is the pedagogical approach which the instructors in this project tried to incorporate into their online classes, at least to some degree. One can also use mixed strategies; for instance, there might be two or more groups, each of which collaborates internally but which also competes with other groups in the class.

For example, most courses included one or more "seminar" type segments in which the students became the teachers. Individual or small groups of students were responsible for reading material not assigned to the rest of the class; preparing a written summary for the class of the most important ideas in the material; and leading a discussion on the topic or material for which they were responsible. Seminar format is generally restricted to small classes of very advanced students in the face-to-face situation, because it is too time consuming to have more than about 15 students doing major presentations. Secondly, less advanced students may feel very embarassed and do not present material well in an oral report to their peers, and are even worse at trying to play the role of teacher in conducting a discussion. In the written mode, they can take as long as they need to polish their presentations, and the quality of their work and ideas is what comes through, not their public speaking skills. Other students can read material in a much shorter time than it would take to sit through oral presentations. If the material is poorly presented, they may hit the "break" key, whereas etiquette dictates that they must sit and suffer through a poor student presentation in the face-to-face situation. Finally, it is easier for students to "play the role" of teacher in this medium, which is more equalitarian than face to face communication. Seminar-style presentations and discussions are thus an example of a collaborative learning activity which is often difficult in the traditional classroom, but which tends to work very well in the Virtual Classroom environment, even with fairly large classes of undergraduates.

Collaborative or group learning has been given many labels in the educational literature, including "cooperative learning, collective learning, study circles, team learning..." (Bouton and Garth, 1983, p. 2), and "peer-group learning" or "syndicates" (Collier, 1980). The various forms include a process of group conversation and activity which is guided by a faculty member who structures tasks and activities and offers expertise. Its basic premise is that learning involves the "active construction" of knowledge by putting new ideas into words and receiving the reactions of others to these formulations:

> Students cannot simply assimilate knowledge as it is presented. To understand what is being said, students must make sense of it or put it all together in a way that is personally meaningful... It is as if one were to teach a child to talk by having the child listen in silence to others for the first two or three years of life; only at the end of the period would we allow the child to speak. In reality, the child learns in a continuous process of putting words together and trying them out on others, getting their reactions, and revising speech accordingly... An optimum context for learning provides learners with frequent opportunities to create thoughts, to share thoughts with others, and to hear others' reactions. This is not possible in the traditional classroom (Bouton and Garth, 1983: 76-77).

Collier (1980) summarizes many reports of an increased involvement of students in their courses as a result of group learning structures, including better class attendance (reported by Field, 1973); greater expenditure of time on the work outside of class (Collier, 1966; Rudduck, 1978); greater satisfaction with the course (Beach, 1974; Goldschmid & Goldschmid, 1976) and an increased wish to pursue subsequent studies on the topic (Beach, 1974). Collier also notes that although most reports show "no difference" between courses based on small-group discussion and courses based on lectures and other more traditional modes of instruction (e.g., Costin, 1972), there are some documented cases in which knowledge gained by students was greater in the small-group setting (e.g., Blunt & Blizzard, 1973; Erskine & Tomkin, 1963; Clement, 1971). Finally, there are many reports that group learning enhances "higher-order" intellectual skills, such as the application of learned principles in fresh situations, critical thinking, and the synthesis of diverse materials (Clement, 1971; Costin, 1972; Rudduck, 1978; Abercrombie, 1979).

Studies of Teaching Innovations

A number of other teaching innovations to encourage "active learning," "self-pacing," and/or "immediate feedback," involving either teaching techniques or technological devices, have been described in the literature. Many of these innovations have been reported as pedagogical successes, but they have not been diffused widely because of the demands made on faculty. For instance, Tarter (1982) describes his use of "group incentive techniques" which divided a class into study groups and based part of the students' grades on the daily quiz averages for the whole group. Though successful in terms of increasing student motivation and performance, the technique was abandoned after five years because it was too labor-intensive to prepare and grade daily exams.

The "PSI" or Personalized System of Instruction (Keller and Sherman, 1974) emphasizes self-pacing, the use of written materials, tutorial assistance for learning from student peers, and "mastery learning." (Students must score 90% or better on a test unit before moving on to another unit.) Malec (1982) reports that the advantages are that students learn more and like the method; the major disadvantage is that the method requires a great deal of pre-course preparation and a fairly elaborate administrative apparatus. Though Malec confirms that after nine years of PSI in a statistics course, he was still using the method, he laments that despite presentations, articles, and videotapes, he is not aware of a single other colleague at his institution who had adopted the method.

There are thus many competing and complementary educational innovations. In order for the Virtual Classroom to be a "success," it must not only "work," but its use must diffuse among educational institutions. In the long run, diffusion of the innovation may be much more difficult and problematic than the technological progress on which it is based.

Computer-Mediated Communication Systems

CMCS's use a computer to facilitate communication among people who are dispersed in space or time. Although available since the early 1970's (Turoff, 1972), CMCS's were not widespread until the 1980s, when personal computers became widespread in offices, schools, and homes.

The most common form of CMCS is "electronic mail" or message systems, which deliver discrete text communications from a sender to one or more recipients via computer networks. Message systems are one-to-one or one-to-many replacements for the written internal memo, the letter, or the telephone call. Conferencing systems are structured to support cooperative group work and group discussions.

There is extensive literature on CMC, encompassing hundreds of books and articles. (For reviews, see Rice 1980, 1984; Kerr and Hiltz, 1982; Hiltz, 1986a; Steinfield, 1986; Culnan and Markus, 1987. For a general discussion of CMCS, see Hiltz and Turoff, 1978; Johansen, Vallee, and Spangler, 1979; Uhlig, Farber, and Bair, 1979; Rice 1984. Hiltz and Turoff, 1985, discuss alternative structures for CMCS). "Structure" can be provided by software tools or by explicit statement of guidelines for interaction. Among the objectives of such structuring devices are message routing, message summarization, and social organization (Huber, 1982b; Hiltz and Turoff, 1985). Conferencing software usually provides structuring devices such as key words and sequential or trunk-and-branch numbering of discussion items, and often includes special roles or powers for a group leader. If there are data as well as qualitative communications involved, ranging from simple yes-no votes to large tables or files of information bearing on a decision, the computer can serve as a support tool by organizing, analyzing, formatting, and feeding back the data to the group. Finally, special structures can be designed for programs to be executed, such as a Fortran program to be compiled and executed, or a test to be administered.

Early research on the social effects of CMC was aimed at generalizations about the impacts of the new medium. For example, Johansen, Vallee, and Spangler (1979:180-181) summarize a number of studies with the statement that "computer conferencing promotes equality and flexibility of roles in the communication situation" by enhancing candor of opinions and by helping to bring about greater equality of participation. On the basis of early pilot studies comparing face-to-face and computerized conferences, Hiltz and Turoff (1978:124) conclude that more opinions tend to be requested and offered in computerized conferences, but that there is also less explicit reaction to the opinions and suggestions of others. However, the democracy bordering on anarchy which characterizes unstructured or "free discussion" CMC makes it difficult for groups to come to agreement on complex issues or problems (Sproull and Kiesler, 1986).

A second generation of research on CMC seeks a better understanding of the conditions under which the general tendencies of the medium are stronger, weaker, or totally absent. For example, current work at the New Jersey Institute of Technology focuses on the development and evaluation of a variety of new capabilities for CMC. The goal is to discover the interactions among task types, communications software, and individual or group attributes that will allow the selection of optimal system designs and implementation strategies to match variations in user group characteristics and types of tasks or applications.

Much of the research on teleconferencing has focused on the question of the appropriateness of alternative communication modes for different functions. Media differ in "social presence:" the feeling that a medium is personal, warm, and sociable rather than impersonal, cold and unsociable (Short, Williams, and Christie, 1976; Rice, 1984). The paucity of non-verbal cues in CMCS may limit information that serves to improve perception of communication partners, to regulate social interaction, and to provide a social context for communication. On the other hand, participants may explicitly increase overt social-emotional expressions such as greetings (Duranti, 1986) and paralinguistic cues (Carey, 1980), in order to compensate for the missing communication channels.

A controlled laboratory experiment on small group problem solving used Interaction Process Analysis (Bales, 1950) to compare the process and outcomes of computerized conferences vs. face-to-face discussions (Hiltz, Johnson, Aronovitch, and Turoff, 1980; Hiltz, Johnson, and Turoff, 1986). There were proportionately more of the task-oriented types of communication associated with decision quality, and proportionately less of the social-emotional types associated with ability to reach agreement, in the computer conferences. Some analysts have asserted that CMCS are unsuitable for social-emotional communication (e.g., Heimstra, 1982), whereas others have described high levels of social-emotional content which may get out of hand (e.g., Hiltz and Turoff, 1978; Rice and Love, 1987; Sproull and Keisler, 1986). In designing the Virtual Classroom project, we desired to identify software structures and teacher behavior or approaches that would support the full range of communication necessary for effective education, including the social-emotional interaction necessary in order for students to establish cooperative relationships with their instructor and peers.

SOFTWARE TOOLS FOR A VIRTUAL CLASSROOM

A variety of educational institutions are using simple message systems (e.g., Welsch, 1982; Quinn, et. al., 1983) or existing conferencing systems to supplement traditional delivery modes or to totally conduct a course. (An Appendix to volume 2 includes an annotated bibliography providing an abstract for all published case studies that could be located). Particularly notable are efforts by Harasim and her colleagues (Harasim, 1986, 1987; Harasim and Johnson, 1986; Davie, 1987) using PARTIcipate at the Ontario Institute; of Deutshman and Richards and their colleagues, also using PARTIcipate, at NYIT (e.g., Haile and Richards, 1984); of McCreary and her colleagues at Guelph, using COSY (McCreary and Van Duren, 1987); and of Nipper and his colleagues, using COM in Denmark (Nipper, 1987).

Electronic mail has been used in an "adjunct" mode to support classes delivered primarily via other media. For instance, Welsch (1982) reports that electronic mail led to a much more "interactive" class. Even grading became interactive, with the students arguing for better grades on specific papers and making iterative changes to their assignments. Quinn et. al. (1983) also documented a "higher proportion of student turns to teacher turns" in messages exchanged via computer than in the face-to-face classroom. In addition, content analysis showed that the length of responses by students was much longer in computer-mediated communication. These observations about changes in the balance and nature of interaction among the instructor and the class members were also documented in pilot studies of earlier online courses on EIES (Hiltz, 1986).

Our own pilot studies were based on using the existing EIES software to supplement traditional courses or to deliver non-credit continuing education courses. Though the results were promising (Hiltz, 1986b), it was evident that there were many limitations to be overcome, particularly for standard college-level courses that required numerous assignments and examinations as part of the course work. Conceptually, we divided these into a set of structures called Branch Activities which could be attached to a class conference in order to support special types of assignments or delivery of material for activities that were to involve the whole class; a set of teaching support tools to help the instructor manage assignments and grading and quizzes for individual students; and micro-computer based software for the integration of graphical information with text information.

Branch Activities for Class Conferences

BRANCH is the generic term used to describe activities which are attached to comments in a conference. The conference comments form a linearly numbered "trunk;" and the "branches" attach to one of the main conference comments. All of the responses or activities related to that branch are gathered together there, instead of being scattered throughout a conference as many separate comments. Rather than automatically recieving everything that has been entered by any participant, as with comments, participants choose to undertake the activities in a branch only when they are ready do do so, and explicitly give a command. A record is kept of DONE branches and a review choice for branches helps users to keep track of which activities they have completed. While students may access only their own records of done and undone branches, the instructor can review the Branch Activities status of any of the students.

The Branch Activities subsystem was developed specifically to support online classes or a "Virtual Classroom," but it may be useful for other applications.

Currently there are three types of branches. The most frequently used for online classes is the "RESPONSE" branch. One or more questions for response by other conference members is contained in the main conference comment setting up a response branch. All of the responses are attached to this branch (comment) number. Most importantly, the author of a response branch can specify that each person MUST ANSWER BEFORE SEEING THE RESPONSES OF OTHERS. This is very important for making sure that each person can independently think through and enter his or her own ideas, without being influenced by responses made by others. Alternatively, the author of a response branch can allow participants to see responses of others before having an opportunity to add their own response.

A READ branch allows essay or lecture type materials to be divided into sections. Each section has a title, and can be read by selecting that section from the table of contents for the read branch. When you do a read branch, you can choose to read just some sections that particularly interest you, or the whole thing.

SELECTION branch allows the members of a conference to choose selections from a list (such as a list of available topics for student assignments) and indicates who has chosen which item so far. Without such a mechanism, allocating selections to students would require either dictatorship by the instructor, or a barrage of message traffic. The selection branch procedure also has the advantage of motivating students to make their selections early, since whoever makes a selection first gets it. Finally, as soon as a valid selection is made, it is confirmed for the student, who may immediately begin work on the topic.

Some branches may be structured to allow the use of a PEN NAME, so that students may feel more free to communicate about personal feelings. If the conference moderator decided not to allow pen name responses to branches, then everything will be entered with the regular signature.

Finally, Branch Activities may be sequenced. This means that the instructor in a class conference or others who are authorized to create branching activities may specify that two or more branches must be done in a specified order. This allows the instructor to control the order in which various activities or course modules are completed by a student.

No matter what type of Branch Activity one is concerned with, it is accessed through the same menu or interface:

```
BRANCH CHOICE?
Choose From:
   Get Branch               (1)
   Display Branch           (2)
   Review Branch            (3)
   Do Branch                (4)
   Modify/Delete Item       (5)
   Author/Create Branch     (6)
   Set Interaction Mode     (7)
   Monitor                  (8)
   Create/Modify Unit       (9)
```

The user who enters a question mark at "branch choice" receives the following explanation of the menu:

CHOICE	WHAT IT DOES
1	Gets the root comment for a branch item, header plus text.
2	Displays the header for the root comment of a branch.
3	Reviews all branch items and your status on completing each one.
4	"Do"" branch will enable you to respond to a response branch, read a read branch, etc.
5	Allows you to modify or delete a response or branch which you wrote.
6	Allows you to create a branch IF the moderator of the conference gave you that privilege.
7	Allows you to switch to a "batch" mode whereby all branch items print without pausing to ask if you want to see each one.
8	Monitor or teacher privileges to manage the activities.

9 Allows organization and reorganization of individual activities into sequences.

Conceptually, there is no end to the kinds of "Branch Activities" that can be added to a Virtual Classroom. The Branch Activity software consists of a set of programs which lead the author through the process of setting up the activity; a set of programs which lead the participants through actually doing each type of activity; and a common interface for accessing, tracking, and managing the whole set. For instance, with funding from ITT, we are currently adding an activity designed to handle the integration of input to and output from LOTUS 1-2-3 as a type of activity.

We found that adding this new subsystem does create an additional level of complexity and learning time for the student (and faculty member!) However, in large classes with a number of assignments and activities, trying to do everything in a linear conference structure quickly results in a disorganized and unmanageable situation for both students and teachers.

The only way to implement a special subsystem such as Branch Activities within EIES1 is to use its fully interpreted high-level language, INTERACT. While INTERACT is relatively easy to change and thus suited for a system under development, it runs slowly: Delays of 30-60 seconds are not uncommon. The larger the subsystem gets, the more slowly it runs.

In the new system being built called TEIES (Tailorable Electronic Information Exchange System), activities will be an integral part of the architecture and will not operate particularly slowly. For this prototype implementation of Virtual Classroom structures, the decision was made to support only three types of Branch Activities, and to develop other special programs and types of activities as separate routines, not slowed down by the overhead of the Branch Activities subsystem on EIES1. This next set of special tools relates to individual assignments, rather than to shared activities in conferences; thus it also differs in that the use of these tools was channeled through messages and notebooks, rather than through the shared class conference.

Instructional Management Tools

As both a systems analyst familiar with EIES1 and Interact, and an instructor in the Virtual Classroom project, B.J. Gleason was in an ideal position to develop a series of instructional management routines (see Gleason, 1987, for a manual and full description). These included:

- .Makequiz, Quiz, and Grader-- Makequiz allows an instructor to create an online quiz, which may consist of a variety of forms of questions (e.g., multiple choice or other "objective" questions, essay questions, or "short answer" responses such as the answer to a computation problem). Quiz allows the student to take an online quiz, and Grader guides the automatic grading and issuing of messages to students reporting their grades on the quiz. There is also a spreadsheet-like program, "Gradebook," which organizes and computes weighted averages for all grades for each student, and which students can consult to see their grades and average at any time.
- ."Assignment" and "Handin" automatically organize and track all student responses to a single assignment in a designated page in the instructor's notebook. For large classes with many assignments, this can be very important, since otherwise the instructor would have to find, sort, and transfer each of the individual assignments arriving as messages.
- .Pascal, Fortran, and Debug provide for compiling Pascal or Fortran

programs in a "batch" or "background" mode on EIES. This set of tools for courses involving programming allows the instructor to see the program as well as the compiled result, in order to improve ability to help students and to comment on the quality and correctness of their code.

Personal TEIES: Integrating Graphics and Text

The objective of Personal TEIES is to allow an instructor or student to compose and display, on a microcomputer, text that is integrated with simple graphics, including pictures and mathematical symbols. The graphics are composed using a subset of the Graphical Kernel System and are then encoded in NAPLPS, the North American Presentation Level Protocol Syntax, for transmission and storage in EIES, TEIES, or any other CMCS that accepts ASCII code. The initial version was implemented for the IBM PC and compatibles; we hope to implement future versions for the McIntosh and other popular types of microcomputers.

The graphical items created and displayed in Personal TEIES are meant to emulate a blackboard in the traditional classroom, with class members not only able to look at one another's drawings, but also able to "erase" and "redraw" an item. Because it is encoded in NAPLPS, rather than communicated as a bit-map, it can be transmitted over a telephone line; and, when versions for different micros are completed, a graphical item drawn on an IBM-PC compatible could be displayed by a user of another brand of micro.

Unfortunately, Personal TEIES was much more difficult to implement in the IBM-PC environment than we had anticipated. A completely operational version was not ready until the end of March, 1987. This version was used for a few exercises in Math 305, the other courses had to get along without the graphical capabilities which we had hoped to provide. (See Foster, 1986 and 1987, for the initial and final specifications for Personal TEIES; Harting, 1986 for the user's manual for version 1.0. We did learn a lot from the limited trials with the initial version.)

THEORETICAL FRAMEWORK

This study builds upon previous work on acceptance of computer-mediated communication systems and on teaching effectiveness, both in conceptualizing the variables which can be expected to affect the process and outcome of online courses, and in operationalizing the measures of outcomes.

Dependent Variables: Measuring the Success of the Virtual Classroom

"Acceptance" or "success" of computer systems is sometimes assumed to be unidimensional. For instance, if employees use an interactive computer system, then it may be defined by management as "successful." "Technicists" (see Mowshowitz, 1981) or "systems rationalists" (see Kling 1980) may assume that if a system is implemented and being used, then the users must like it, and it must be having the intended beneficial impacts. However, many social analyses of computing assume that it is much more problematic whether or not systems have beneficial effects on users as individuals and on productivity enhancement for organizations. (See, for instance, Keen, 1981; Attewell and Rule, 1984; Strassman, 1985).

Three components of acceptance of Computer-Mediated Communication Systems (CMCS) were found to be only moderately inter-related in a previous study of users of four systems: use, subjective satisfaction, and benefits. (Hiltz, Kerr, & Johnson, 1985; Hiltz, Johnson and Turoff, 1986). The same three dimensions of "success" will be used in this study. It is expected that there will be positive but only moderate correlations among the amount and type of use of the system made by a student; subjective satisfaction with the system itself; and outcomes in terms of the effectiveness of learning. Measures of the effectiveness of learning or "outcomes" and of subjective satisfaction with the system are described in the chapter on Evaluation Methods. We have several key measures of amount and type of use: total hours of connect time, number of logins, number of conference comments composed, number of private messages sent, and number of different addressees to whom private messages were sent.

The Independent Variables

Among the theoretical and empirical approaches to studying the acceptance and diffusion of computer technology and its impacts on society, four major approaches were identified: Technological Determinism (characteristics of the system); the Social-Psychological approach (characteristics of the users); the Human Relations school (characteristics of the groups and organizations within which systems are implemented); and the Interactionist or Systems Contingency perspective. This classification of four alternative theoretical approaches represents a selection and blending of perspectives presented in the work of Kling (1980) and Mowshowitz (1981) on theoretical perspectives on computing and from Zmud (1979) and others who have looked at the effects of individual differences on the adoption of MIS and other technologies.

Technological Determinants

Rob Kling, in his review of theoretical approaches (1980), identifies the "systems rationalists" as those who tend to believe that efficiently and effectively designed computer systems will produce efficient and effective user behavior. Mowshowitz's typology of theoretical approaches to the study of computing issues has a parallel category, the "technicist," who "defines the success or failure of particular computer applications in terms of systems design and implementation" (Mowshowitz, 1981: 148). From this viewpoint, characteristics of the system or technology determine user behavior. For example, Turner (1984) showed that the form of the interface of the applications system used by social security claims representatives affected both attitudes toward the system and job satisfaction and performance. Applying this approach to prediction of success of the Virtual Classroom, the technological and rational economic factors which would be expected to be important in explaining user behavior include access to and reactions to particular aspects of the hardware and software and the cost in time and money of using the new system compared to other alternatives for educational delivery.

To the extent that these assumptions are correct, we would expect to find that reactions to the particular hardware used would account for a great deal of the variance in success. For instance, we would hypothesize that students with a microcomputer at home and a 1200 baud modem would be most likely to fully benefit from this technology. In addition, we would expect to find high correlations between subjective satisfaction with the system, and amount of use and benefits. We would also expect to find few differences among courses; the same technology should have the same impacts on all classes and students. The relative power of technological determinants can be assessed by examining the results to see if they support these predictions.

Individual Differences as Predictors

The PSYCHOLOGICAL or "individual differences" approach to predicting human behavior when confronted with a new technology would emphasize characteristics of the individual: attitudes and attributes, including "personality type," expectations, beliefs, skills, and capabilities (Zmud, 1979). Attitudes consist of an affective dimension involving emotions ("Computers are fun") and a cognitive dimension based on beliefs ("Using this system will improve my education.") As applied to this study, we predict that pre-use expectations about the specific system will be strongly correlated with subsequent use of and reactions to the system. Among the individual attributes which we expect to affect success are ability (measured by SAT scores), sex, and ethnic group or nationality. We do not expect age, previous use of computers, or typing skills to affect use or outcomes, but we included them in order to check for these influences. Measures of these variables are straightforward; the specific proposed questions may be seen in the Appendix.

The personality-level attributes that we expect to affect success have to do with self-discipline, which may be related to perceived Sphere of Control; we predict a moderate relationship between measures of Sphere of Control and acceptance.

Sphere of control-- Work on the conceptualization and measurement of "locus of control" built for many years on the work of Rotter (1966), who devised a single scale to measure Internal vs. External Locus of Control. Paulhus (1983; see also Paulus and Christie, 1981) devised a new set of thirty items based on a theory of three separate "Spheres of Control" (SOC) that could vary independently. Personal Efficacy as a sub-scale measures control over the nonsocial environment, as in personal achievement being a result of one's effort rather than "luck." Interpersonal Control measures control over people in dyads and groups. Sociopolitical control refers to control over social and political events and institutions. A confirmatory factor analysis, correlations with measures on other scales, and experimental research which predicted behavior on the basis of SOC subscale scores supported the reliability, validity, and utility of the three subscales.

For this study, the personal efficacy and interpersonal control scales are included in the baseline questionnaire, in the section labelled "images of yourself." The items for the two sub-scales are inter-mixed.

Group or Course Differences

The HUMAN RELATIONS approach "focuses primarily on organizational members as individuals working within a group setting" (Rice, 1984). The small groups of which an individual is part are seen as the most powerful determinants of behavior. From this perspective, participation in the decision to use the Virtual Classroom, user training and support, the nature of existing ties among group members, and the style of teaching or group management (electronic or otherwise) are crucial determinants of the acceptance and impacts of a new computer or communications technology. Based on this theoretical perspective, we expect large differences among the courses in which the students are enrolled, corresponding with differences in social interaction among the groups and in skill and level of effort of the teacher.

Two families of theoretical perspectives are not tested in this study. Kling (1980) refers to them as "organizational politics" and "class politics." The organizational politics approach will undoubtedly be fruitful in trying to understand resistance to this innovation in some organizations. However, it would require sampling organizations and identifying Virtual Classroom proponents and opponents within them, rather than sampling users of the system in only three organizations, as we have done. It will be useful in assessing diffusion of the software to other organizations. The latter theoretical approach, which is paralleled by Mowshowitz's (1981) category of "radical criticism," is an ideological perspective that views computer technology as a new form of exploitation of the working class by capitalists. The impacts of computer technology are assumed to be harmful to society. We did not include hypotheses and data collection techniques which could test the relative power of this perspective.

The Interaction or Systems Contingency Model

The "Interactionist" (Markus, 1983) or "Systems Contingency" (Hiltz, 1986) approach to the social impacts of computing was adopted for this study. In this model, no single one of the above three classes of variables is expected to fully account for differences in success of the Virtual Classroom; all are expected to contribute. However, these sets of variables are not simply additive; they interact to form a complex system of determinants. For example, student ability and attitudes are presumed to interact with educational technology: favorable outcomes are contingent on certain levels of student ability and motivation. This theoretical perspective can be equated with what Kling (1980) calls the "package" or interactionist approach to the social impacts of computing. In Mowshowitz's classification, we are termed "pragmatists," taking the position that "the use made of computers is determined in part by the social or organizational settings in which they are introduced" (Mowshowitz, 1981: 150).

EDUCATIONAL OUTCOMES TO BE MEASURED

Educational outcomes of a delivery medium can be looked at for both students and for faculty members. The quantitative data to be collected focuses upon outcomes for students. Qualitative or anecdotal data were relied upon to document effects on the instructors, since with only a handful of faculty members participating, statistical analysis would not be fruitful.

Mastery

Shavelson et. al. (1986, p. vi.) state that

> Telecourse evaluations must ultimately focus on outcomes and address the exchangeability of these outcomes with those attained by students in traditional courses. By "exchangeability" we mean the extent to which the knowledge, skills, and attitudes acquired by students from a telecourse are interchangeable with the knowledge, skills, and attitudes that are: (a) valued by faculty and administrators, and (b) acquired by students enrolled in the same course offered as part of the traditional curriculum.

The most basic of the desirable outcomes for a course is mastery of the fundamental facts, concepts, and skills which the course is designed to teach. Such mastery is usually tested by examinations and assignments which are graded. Of course, a score for a ten minute quiz or a one-hour essay question is only a proxy measure for student mastery of the content of a course. Students can also be asked to report their impressions of the extent to which a course improved their mastery of concepts, skills, or facts. Post-course questionnaire items drawn from widely-used measures of teaching effectiveness were included for this purpose. We will use both instructor-assigned grades and student self-reports to measure achievement of learning goals in a course. If there is no difference in test scores for material presented online vs. material presented in traditional face-to-face courses, we may consider this a criterion for minimal "success" of the Virtual Classroom.

Given that previous studies of courses delivered by television or other non-computer media tend to indicate "no difference" in this basic outcome, (e.g., Schramm, 1977), we do not expect significant differences in grade distributions between VC and TC sections of a course. Though there may be some variation from course to course, depending upon the nature of the subject matter and the characteristics of the students, we expect that overall:

HYPOTHESIS 1: There will be no significant differences in scores measuring MASTERY of material taught in the Virtual and Traditional Classrooms.

Measuring Improved Writing

Since all communication in the VC is in writing, and students will see one another's writing, practice in written communication may improve skills. Good writing in fact combines a number of skills, including organization, sentence structure, grammar, and the almost indefinable elements of "voice" and of "style" that make it interesting or engaging. Thus, improvements in writing skill are very difficult to measure.

Computers in the form of text processors and spelling checkers have been used from elementary school on up to try to both speed up and improve the writing process. As Daiute (1985) points out, if electronic mail or computer conferencing is added to the word processing capabilities, one can expect some additional possible improvements, because after all, writing is supposed to be a "social" process, a process of communication. Using the computer not only to assist in the manipulation of text but also to communicate it to others may help to provide motivation, a source of collaboration or constructive criticism, and a defined "audience." "Setting writing in a wider communication context can help students express themselves more naturally, even when they are writing formal essays" (Daiute, 1985, p. 5). Moreover, "The computer conference can be a tool for consolidating and transmitting ideas in writing at a time when the writer feels most communicative, most excited, or most confused" (ibid., p. 25).

As Daiute (1985, p. xiv) points out:

> With the computer as the instrument, writing is more like talking. Writers interact with the computer instrument, while the pen and the typewriter are static tools. The computer enhances the communication functions of writing not only because it interacts with the writers but also because it offers a channel for writers to communicate with one another and because it can carry out a variety of production activities. Writing on the computer means using the machine as a pencil, eraser, typewriter, printer, scissors, paste, copier, filing cabinet, memo pad, and post office. Thus, the computer is a communication channel as well as a writing tool. The computer is a language machine.

Freed from the need to constantly recopy when revisions are made, the student using a word processing program can supposedly revise more easily and thus produce a better final version. However, using the computer in the writing process can have disadvantages as well as advantages. (For some case studies and reviews, see Bridwell, Sirc, and Brooke, 1986; Collins, 1982; Daiute and Taylor, 1981; Kiefer and Smith, 1984; Malone, 1981.) Non-typists may be able to write much faster by hand than by using a keyboard. In addition, in order to write using a computer, the student has to access and "power up" the equipment and software, and learn to use the commands of the text editing system as well as of the larger computer system in which it is embedded; this imposes an added burden. The few studies of comparative writing quality have shown that writing on the computer is sometimes rated lower than writing done by the same people with traditional tools. It may be more "sloppy," because it is more like talking. Spoken sentences often are loosely constructed, and there tend to be more grammatical errors in speech, and more use of phrases such as "sort of" and "kind of." Computer drafts also tend to have more spelling errors (which may be "typos") and syntax errors caused by omitted and repeated words. Finally, "this research is not conclusive, because none of the studies have been done after the writers have become as comfortable with the computer as they are with pen or typewriter" (Daiute, 1985, p. 113).

The major objective of the Writing Seminar at Upsala College is to improve writing. The students in one of these classes had the Virtual Classroom available for part of their work. All of their writing assignments were done in small groups online, and the students were asked to critique one another according to guidelines provided by the instructor. The impact on their ability to write clearly and well was assessed using data generated by standard before-and-after testing procedures at Upsala. Every Freshman is given a "holistically graded" written essay exam upon entrance, and again a semester later, after the writing course has finished. We took advantage of this existing data to compare changes in writing scores for the experimental online section with changes for students in the other sections.

HYPOTHESIS 2: Writing scores will improve more for students in a writing course with access to the Virtual Classroom than for students in similar courses who do not use the system.

Of course, there are other factors which may affect the validity of any such conclusion. Students will not be randomly assigned to the various sections, and the teachers and specific topics used for writing assignments will vary. There is a methodological question as to whether this single "holistic" assessment of writing quality may be able to capture specific types of improvements that may occur. Moreover, there is a serious question as to whether any single semester-long course can significantly improve writing. However, statistical tendencies toward a difference associated with system use can be interpreted as promising for more controlled experimentation with writing courses in the future.

Other Outcomes

There are many goals related to educational process and outcomes that are desirable to achieve, other than high scores on examinations. These less tangible or higher level changes may actually be of more long-term value than the ability to score well on a test covering a specific set of subject matter material at a particular point in time. The capitalized words or phrases in the list below will be used in the remainder of this document to refer to the indicated outcome. The variables are given a brief conceptual definition below; their operational definitions are specified in later sections of this report.

HYPOTHESIS 3: VC students will be more likely than TC students to report each of the following:

3.1 CONVENIENT ACCESS to educational experiences.

3.2 Increased PARTICIPATION in a course. This may be due to convenience or ease of participating, and may be reflected in the regularity and quality of their assignments, reading, and contributions to class discussion. Though this may be considered a "process" rather than an "outcome" variable, student participation in the activities of a course is usually considered a desirable objective in and of itself.

3.3 Improved ability to apply the material of the course in new contexts and EXPRESS their own independent IDEAS relating to the material.

3.4 Improved ACCESS to their PROFESSOR.

3.5 Increased level of INTEREST in the subject matter, which may carry beyond the end of the course.

3.6 Improved ability to SYNTHESIZE or "see connection among diverse ideas and information" (Davis, Dukes, and Gamson, 1981). Kraworth et. al. (1964) define "synthesis" as "The putting together of elements and parts so as to form a whole, arranging and combining them in such a way as to constitute a pattern or structure not clearly there before."

3.7 COMPUTER COMFORT- improved attitudes toward the use of computers and greater knowledge of the use of computers. This was measured by repeating questions on attitudes toward computers before and after the course, and by directly asking the students if they have improved their computer competence.

3.8 Improved ability to communicate with and cooperate with other students in doing classwork (Group COLLABORATION).

3.9 Improved Overall QUALITY, whereby the student assesses the experience as being "better" than the TC in some way, involving learning more on the whole or getting more out of the course.

One or two items are included to measure several other possible desirable outcomes of a course; these were not embraced as an explicit objective of any of the experimental courses in this study and are therefore included in only a minimal way. These include better "critical thinking" skills (Ennis, 1962), greater self-understanding, and greater understanding of ethical issues in a field.

Collaborative Learning as an Intervening Variable

Group collaboration experience has been listed above as a possible desirable outcome of a course. It is listed as a desirable objective in itself, because in "later life" people will often have to work together on team projects, rather than carrying out separate competetive efforts. "Group" or "collaborative" learning is also conceptualized as a key means or process in the Virtual Classroom environment, that may aid in achieving other objectives such as mastery of the material. For instance, when all students are entering their assignments online, it is much easier to encourage students to look at and learn from one another's work than in the TC, where massive amounts of photocopying would be necessary to attain the same objective. However, some students may not take advantage of these opportunities to learn from their peers.

GROUP LEARNING was measured for all participating students with a set of four items included at the bottom of the "general information" page of the post-course questionnaire. In addition, for those students using the system, a number of items on the section labelled "comparison to traditional classrooms" were used as indicators.

HYPOTHESIS 4: Those students who experience "group" or "collaborative" learning in the Virtual Classroom are most likely to judge the outcomes of online courses to be superior to the outcomes of traditional courses.

While collaborative learning experiences may also be related to educational outcomes in the TC, this potential relationship will not be explored in this report.

There may be conflict or inconsistency among some of the goals and processes in the Virtual Classroom. For example, self-pacing may conflict to some extent with collaborative learning. Irregular patterns of participation, though convenient for the individual learner, may make it difficult for groups to complete collaborative projects within a set time frame. In addition to examining measures of each of the individual processes and outcomes of interest, the project will assess the extent to which they are mutually supportive (positively correlated), independent (not correlated), or incompatible (negatively correlated).

Correlates of Outcomes

In accordance with the theoretical framework adopted, there are many factors in addition to collaborative learning experiences that are expected to be associated with outcomes.

HYPOTHESIS 5: Differences among students in academic ability (e.g., as measured by SAT scores or Grade Point Average) will be strongly associated with outcomes in the Virtual Classroom. High ability students will report more positive outcomes than low ability students.

Good reading and writing skills are a precondition for collaborative learning in this environment. An online course replaces all oral explanation with a writing-based discussion. Learning depends on asking questions and receiving responses from the instructor and the other students. Students who lack basic communication skills are likely to be unable or unwilling to formulate questions about any difficulties they are having. Since many of the courses included have a mathematical foundation (the two statistics courses and the computer science course) basic ability to comprehend mathematical material in a written form may also be correlated.

Another individual-level set of characteristics that is likely to be related to outcomes is attitudes and expectations. Students must be motivated in order to discipline themselves to sign on regularly and participate actively. The relevant expectations include attitudes toward computers, toward the system that will be used, and toward the course.

HYPOTHESIS 6: Students with more positive pre-course attitudes towards computers in general and towards the specific system to be used will be more likely to participate actively online and to perceive greater benefits from the VC mode.

As discussed in the section on theoretical perspectives, the personality attributes related to self-discipline and achievement motivation that are expected to be correlated with student behavior in the VC may be tapped by measures of "sphere of control."

HYPOTHESIS 7: Students with a greater "sphere of control" on both the personal and the interpersonal levels will be more likely to regularly and actively participate online and to perceive greater benefits from the VC mode.

Students do not take courses online within a homogeneous context. They take a particular course, which develops a social structure, heavily influenced by the style and skill of their instructor in conducting the course. According to the "human relations" approach, we would expect process and outcomes to differ among these groups or courses.

HYPOTHESIS 8: There will be significant differences in process and outcome among courses, when mode of delivery is controlled. (Another way of stating this hypothesis is that there will be an interaction effect between mode and course).

Implementation Issues

Adoption of this innovation is not likely to be strongly influenced by findings on comparative outcomes of traditional and virtual classes. It is more likely to be decided on "political" and practical economic grounds.

As Shavelson et. al. note,

> The telecourse is a controversial, emotionally charged issue in higher education. To some it represents a threat--indeed, the greater the sophistication of the course, the greater the competition and threat to traditional educational institutions, their curricula, and instructors.

Case study methods were used to document implementation issues. In particular, opposition to the experiment was recorded as well as dealt with. The practical problems of implementing the courses, and the costs in terms of time and hassles to faculty and staff, were described. This recording of largely qualitative aspects of the implementation can be used to suggest the sorts of problems and possible solutions which may be relevant for future implementations. The following is the outline of descriptive material on implementation which each instructor offering a completely or partially online course was asked to include in their case report:

1. Description of the topics covered in the course, with a syllabus or outline of what was covered week-by-week.
2. Description of the materials and activities provided for the online class (type, length, frequency). How did this differ from TC class materials, activities, and scheduling, and why?

3. Description of what worked well in terms of students seeming to learn and to participate: and the major problems (things that did not go over well). Included here might be problems with procrastination (uneven and delayed participation); software or hardware inadequacies; and getting students to actively ask questions or discuss issues. Also included should be a section on any "group" or "collaborative" learning activities; how these worked and how they did not.

4. This narrative case history should be produced the first time an online course is offered by an instructor. Later, if the instructor repeats an online section, a postscript should be added describing how the pedagogical goals or strategies were changed for the repeat offering, and how these changes seemed to work.

Implementation issues will therefore be treated in a mostly qualitative manner. The course "case reports" by the instructors are included as an Appendix to the second volume of this study, and will be drawn upon in order to help illustrate and explain the data presented in this volume.

There are two aspects of implementation that can be explored with our quasi-experimental design and examined using quantitative rather than purely qualitative data. These are the effect of course repetition and the effect of the nature of the educational environment, as it varies among colleges. Some of the online courses were repeated a second time. Because the VC is a new approach to teaching, we expected that instructors would learn from their first attempts and improve their skills for teaching online with practice.

Hypothesis 9: Outcomes for the second offering of a VC course by an instructor will be significantly better than those for the first attempt at teaching online.

In addition, the Virtual Classroom was implemented within two very different educational environments. It will not be possible to disentangle which differences between Upsala and NJIT may be most important in explaining any differences in outcomes. However, it can be expected that these outcomes will be influenced by differences in access to equipment, skill level and computer experience of the students, and the general "educational environment" within which the experiment took place.

Hypothesis 10: There will be significant differences between the Upsala and NJIT implementations of the Virtual Classroom, in terms of both process and outcomes of the online courses.

Two Modes or Three?

In the hypotheses above, mode of delivery is dichotomized: courses using VC vs. courses conducted totally in a Traditional Classroom environment. The initial design for this field study anticipated only two modes of delivery. In fact, as actually implemented, we had three modes of delivery: totally VC, totally TC, and mixed. Is the mixed mode simply a variant of the VC, some sort of average of the other two modes? We have no prior studies to serve as a basis for answering this question, but we suspect that it is not.

Hypothesis 11: Results for the "mixed" mode will not represent a simple "average" of results for totally VC and totally TC modes, but will represent a distinctive set of strengths and weaknesses.

This is an admittedly vague statement. What it means is that in each of the preceding hypotheses, we will be aware that there may be significant differences between VC courses offered totally online and those offered in a mixed mode.

SUMMARY OF CHAPTER 1

The primary goal of the project, "Tools for the Enhancement and Evaluation of a Virtual Classroom," is to demonstrate that it is possible to use computer-mediated communication systems to improve access to and the effectiveness of post-secondary educational delivery. The most important "product" of the project is knowledge about the advantages and disadvantages of this new technology, as they may be influenced by variations in student characteristics and implementation techniques and settings. The two key questions are:

- Is the Virtual Classroom a viable option for educational delivery? That is, are outcomes, on the whole, at least as good as outcomes for traditional face-to-face courses?
- What variables are associated with especially good and especially poor outcomes in this new teaching and learning environment?

Previous studies of teaching effectiveness, acceptance of computer-mediated communication, and results of pilot projects employing the Virtual Classroom approach influenced the selection of variables and measures. This chapter has presented 11 hypotheses that were used to guide the data collection and analysis strategies.

CHAPTER 2

RESEARCH METHODS

The co-existence of several evaluation goals, and the practical fact that the Virtual Classroom is still a relatively rare occurrence, led to the adoption of a dualistic evaluation plan. Steve Ehrmann (1986), the Annenberg/CPB staff officer working with the project, speaks of "uniform impacts" and "unique uses" evaluation. In regard to the former, one is seeking the "average" impacts of the new educational practice or program, and a form of experimental design is most appropriate. One asks what the educational innovation "does" to the students. The "uniform impacts" approach is focussed on finding out if particular types of changes occur at a statistically significant level, no matter how much or how little the "absolute" amount of such changes may be. An alternative approach is to ask what the teachers and the students do with the technological innovation.

In the "unique uses" perspective, an educational innovation can be viewed as a set of incentives and resources being offered to students; students are the actors, not the objects. The "consequences" of a program are "caused" by the choices and characteristics of the individual instructor and the individual students within the setting. An "excellent" innovation "stimulates students into a range of important kinds of learning and other beneficial outcomes" and/or "stimulates faculty to continued engagement with and improvement of teaching" (Ehrmann, 1986, p. 7). The nature of these outcomes may differ qualitatively as well as quantitatively from student to student or course to course. One wants to know if there are any major changes: What are the most important things that happened? Generally "unique uses" cannot be predicted ahead of time.

In evaluating, it is desirable to capture and describe cases of "unique uses" with such "excellent" results, or, by contrast, cases with notably poor results. These "cases" may consist of entire courses, related to characteristics of the subject matter or of the mode of use of the VC technology by the instructor; or, the "cases" may consist of individual students, in relation to their motivation and ability or other characteristics.

TARGET COURSES AND SUBJECTS

Annenberg/CPB was interested specifically in two undergraduate courses, Introductory Sociology and Introductory Statistics, and was willing to support an Introductory Computer Science course online. Introduction to Sociology (SOC 150) was offered through Upsala; it is taken primarily by freshmen and has no prerequisites. Introduction to Computer Science (CIS 213) is a second-level course at NJIT, with a course in Fortran as the prerequisite. The statistics course was offered in two versions: a freshman-level course at Upsala with no mathematical prerequisites except acceptable scores on a Math Basic Skills test; and an NJIT upper-level first course in statistics for engineers, with a calculus pre-requisite. The Upsala course is actually a half-course; during the first six weeks of the semester, the Freshmen take Introduction to Computers. The half-course in statistics is a new part of a required core curriculum.

For these target courses, a quasi-experimental design of matching face-to-face and online sections of the same course, all offered during the fall of 1986, was selected. The design is quasi-experimental rather than a fully controlled experiment for two major reasons. Students self-selected mode of delivery and the nature of assignments differed between matched sections. Efforts were made to encourage students to register in the experimental section, but only with full understanding of its experimental nature as an "unproven" method of delivery. This set of courses provided the primary data to be used in the assessment of exchangeability of outcomes of the virtual and traditional classroom means of delivery.

Initially, it had been intended to use exactly the same assignments in the matched online and Virtual Classroom sections of courses. However, the faculty members pointed out that this would be totally inappropriate, and would fail to take advantage of the unique opportunity offered by the VC for collaborative activities. So, the faculty members were freed to devise whatever assignments they thought most appropriate for this medium, provided the text books and the midterm and final exams were the same.

Each instructor incorporated collaborative activities in the online section which were different from the individual assignments given in the traditional section. This varied widely depending on the nature of the course. For example, in the upper-level statistics course, students could see one another's homework assignments after they had done their own, in order to compare approaches. In some assignments, each student chose one problem to work on instead of doing them all; the rest of the class could see their solution. In Introductory Sociology, many assignments made use of pen names and required students to enter analyses of how general concepts, such as role conflict, applied to their own lives. The use of pen names prevented embarassment in using examples from their own experiences to share with the class. In Computer Science, the VC section had a final assignment requiring a group to complete a complex program by breaking it into subroutines, and then making sure that all the subroutines worked together to produce the correct overall result. Such an assignment was possible only for a group able to work together constantly, and to have an integrated facility online for showing programs to one another, compiling, and executing them. The traditional section had only simple, individual programming assignments.

However, these introductory courses are not at all representative of the range of applications of the Virtual Classroom, or for exploring variations in process and outcome in such an environment. For these purposes, the sample was expanded to include many other courses which used the VC mode of delivery. For example, whereas all the instructors had extensive experience delivering courses in the traditional mode, this was a "first time" experience teaching an entire course in a Virtual Classroom. On the basis of this experience, they might change their minds about effective procedures in this new mode. It was possible to schedule online sections of the computer science and the two statistics courses to repeat in the spring semester; but not possible, given teaching load and limits, to also schedule a second "control" course in the spring of 1987. Therefore, the sample was first expanded to include a repeat of three courses online.

Secondly, there are many potential applications of the "VC" in a "mixed-modes" format. Some part of the course is conducted face-to-face, and a part occurs online. A total of five courses using this mixed mode of delivery were included: an introductory management course, a writing course, organizational communication, anthropology, and business French.

The introductory management course (OSS 471) offered at NJIT is a particularly interesting "mixed modes" application. This course aims to give seniors with majors in disciplines other than Organizational and Social Sciences sufficient knowledge and skills to learn "how to manage" in a single course, since many of them will eventually assume managerial positions within their professions. It had not been planned as part of the quasi-experimental study. Its instructor, Enrico Hsu, had been a student in one of the partially online graduate courses conducted during the first year of this project. He was beginning his first year of full time teaching at NJIT. Two weeks before the start of the fall semester, he approached the project director with a plan for an online "Management Laboratory." It sounded like a promising and very innovative use of the technology, there was a second section taught by the same instructor which could serve as a control, and so we said, "OK," not quite knowing what to expect. What would turn out to be one of the most successful applications of VC was thus an unplanned, last-minute addition to the project, created by an instructor who was inspired to design a new type of use for the technology.

In both the fall and the spring, there was an "experimental" and a "control" section of this management course. The control or traditional section completed all course activities in the traditional manner. The major course assignment involved the organization and simulated operation of a company over a "fiscal year." The control sections did this by meeting face-to-face during one of the scheduled class times periodically, and by communicating by telephone or written memo or out-of-class meetings in between. The experimental sections carried out their management laboratory assignment completely online. There was a class conference for general discussion and seperate conferences and notebooks where the simulated organizations conducted their business. In looking at some of the data on this course, we found that the amount of usage was actually heavier than in several of the courses that were totally online. For many analyses, therefore, this course will be included along with totally online courses. The Spring face-to-face section was selected as the "control," since the fall face-to-face section was inadvertently omitted from distribution of baseline questionnaires, and only about half of its students completed the post-course questionnaire.

The applications of the mixed mode are described for most of the other courses in an Appendix to the second volume of this report. Unfortunately, the instructor for the Business French course, Dr. Glenn Halvorson, died suddenly just after the academic year ended and was never able to complete his course report. In that course, the conference was used for a role playing exercise throughout the semester, with the students writing "business letters" in French to one another in the conference, relating to the hypothetical negotiations which might be undertaken by Americans conducting business in France. Professor Halvorson was inspired to try this simulation partially as a result of hearing about the Management Lab application, and in fact, Prof. Hsu occasionally "dropped into" the scenario and took part.

The Freshman Writing Seminar is also of particular interest. In addition to a class conference for general announcements and discussion, the class was divided into three writing groups. In each group, each student entered drafts of assignments using a pen name. They were then guided and encouraged to make constructive suggestions for improving one another's drafts, with these critiques also entered with pen names.

Besides the specific courses in Sociology and Statistics required by the terms of the contract from Annenberg/CPB, the other courses were included on the basis of the teaching abilities and interests of specific faculty members in participating in the experiment. The project director wished to have a variety of courses represented, and actively recruited faculty members who were known to her as good and innovative teachers, and who had used EIES in the past and seemed to enjoy it.

Faculty who offered completely online courses were given two months during the preceding summer to prepare materials for the online mode of delivery; and one "released course" during the fall to support their additional work in offering the course the first time, and preparing reports for the project. No additional released time was given for an online course repeated a second time. Those faculty members who offered partially online courses were paid for five days total time for their preparation of reports and participation in the research and planning related to the project. The actual time that they invested in the project was generally much more than the five days that they were paid for; obviously, they were "believers" in the medium, rather than a random sample of faculty members.

There are many ongoing sets of courses which are currently being offered by other institutions online, but for which there is no traditional equivalent. These include graduate level courses in media studies, offered through Connected Education on EIES, with registration and credit at the New School. Begun in 1986-87, a series of two-month long master's level courses is offered throughout the year. At least one student has already completed an entire master's degree online. Each student was included in the study only once, even though they might have taken six or more courses during the year. The response rate for the mailed questionnaires to this group was much lower than the response rate for questionnaires administered or collected during the face-to-face meetings on the first and last days of the NJIT and Upsala courses that were totally online. Thus, the total number of subjects for Connect-Ed (29) does not reflect the total size of their student body.

Connected education is interesting because of the extreme geographic dispersion of the participants. For instance, one course was co-taught by instructors from Tokyo, Washington D.C., and New York, and had students from North and South America and Asia. Connect-Ed has used the ability to define group commands on EIES to construct an entire electronic campus to support its master's degree program. For instance, there is a "cafe" where students and teachers from all courses may mingle and chat, a "library" and a periodic campus "newspaper."

The "School of Strategic and Management Studies" is offered online on EIES by the Western Behavioral Sciences Institute. A post-graduate series of month-long seminars for executives offered by internationally prominent experts and costing $25,000 for two years, it is another example of the unique kinds of offerings that may occur through this medium in the future. With no grading and a mainly discussion oriented process, the instruments used for undergraduates in this study are hardly appropriate, but WBSI did make all of the transcripts of its courses available for analysis, and some of its students completed a special short questionnaire which was used in compiling the guide for teaching online.

Finally, a post-graduate course offered for teachers by the Ontario Institute for Studies in Education on their PARTI system serves as an example of continuing professional education online. The results for this course will occasionally be displayed and included in the analyses.

The purpose of including these additional courses in the study was to increase the overall sample size, and thus the chances of obtaining statistically significant results. The expanded sample of courses also increases the generalizability of the findings to a wider range of online offerings, and facilitates exploration of variations among online courses.

Table 2-1 shows a categorization of the courses included and the number of subjects in each category. The difference between the number originally enrolled and the number for which we have complete data is due to a combination of drop-outs and failure to complete a post-course questionnaire. A few of the "missing" questionnaires were completed, but were turned in anonymously, so that they can generally be used only in looking at univariate distributions. The total number of students in all courses in the study is 150 totally online, 111 in mixed online and traditional classroom sections, and 121 in "control" or offline sections.

There is an unfortunate confounding in the design; both of the totally online courses at the Freshman level were offered at Upsala, and the two totally online courses at NJIT were at a higher level. With only four totally online courses supported by the project, however, it is inevitable that not all relevant variables could be adequately controlled.

Research Design

The standard experimental design of random assignment to matched sections of traditional and experimental courses is neither practical, ethical, nor particularly relevant. Students cannot be randomly assigned to sections of a course meeting at different times, given the constraints of their other obligations, and the same instructor obviously cannot teach two sections of the same course at the same time. It is not ethical, because this is an experiment; there is some risk that the outcomes will not be favorable, and students should voluntarily agree to assume the risk of using an experimental form of delivery for an entire course. Finally, it is not methodologically sound in terms of estimating future impacts. Students who choose telecourses, especially telecourses delivered via computer, are likely to differ from students choosing traditional courses in non-random ways. They are more likely to have out-of-class obligations which make it difficult for them to attend regularly scheduled classes, for instance, and to have more positive attitudes toward computers. Random assignment is also not methodologically sound when one of the objectives is to explore variations among online classes. There are many online courses for which there simply are no "face-to-face" equivalents, because they are designed specifically for distance education; and many traditional classes requiring laboratory equipment, such as biology or chemistry, for which there is no online equivalent possible at the present time.

Shavelson et. al. (1986) state that three designs can be identified as relevant to evaluating student outcomes from telecourses. These are:

1. "Uncontrolled Assignment to form Non- Equivalent Groups," in which students self-select into tele- or traditional courses. Before and after knowledge and skills are measured. This is the primary evaluation design chosen for this study.
2. "Patched-up Design" is "appropriate when institutions regularly cycle students through the same course, such that students from one cycle can serve as a control group for

students from another cycle." Unfortunately, this is not the case at NJIT or Upsala, and the design can be used only to a very limited extent.

3. "Case Study Methods" provide narrative (descriptive and qualitative) accounts. Elements of the case study method will be included.

The above set of alternative methods, however, ignores the important question of variation in success within telecourses. In examining the question of "assessing interactive modes of instruction," Davis, Dukes, and Gamson (1981) reach the following conclusion:

> Low priority should be given to conventional evaluation studies that compare a control group using a conventional classroom with an experimental group using some interactive technique... We doubt that fruitful, context-free generalizations can be found demonstrating that one technique is uniformly better than another, even for specific learning objectives.
>
> Our alternative approach accepts the fact that these techniques show no evidence of general inferiority to conventional techniques... The focus should be on the conditions under which given interactive techniques are most and least appropriate. We need to know the contextual variables that maximize the effectiveness of a given method (321-322).

Given that the Virtual Classroom is a new educational technology, we do not agree that it is unnecessary to prove that it is just as good as a traditional classroom for MASTERY of facts and information. For this purpose, we will follow the traditional evaluation approach of experimental and quasi-experimental design. For each of five target undergraduate courses, we are attempting to match the same course with the same teacher, texts, and tests in Traditional Classroom mode with a mode employing the Virtual Classroom. Examination scores and other outcomes can then be compared for the two sections. In other words, at the core of the evaluation design is a 2 x 5 factorial design, with each of five courses offered in two modes of delivery (See the top of Table 2-2).

However, this basic design will be supplemented with data from other courses which used the Virtual Classroom in a variety of ways:

(1) The online courses which are repeated fall and spring can also be analyzed as a quasi-experimental factorial design with a 4 (course) by 2 (first vs. second offering) design (middle display of Table 2-2).

(2) We can look at differences among modes in terms of totally online courses vs. traditional classroom courses, vs. mixed mode courses; in other words, a one-factor, three levels of treatment design. This gives us the largest number of subjects; the number for whom at least some data are available is shown at the bottom of the diagram for "design 3."

(3) We can examine contextual factors related to the conditions under which VC was most and least effective. These include differences among courses and organizational settings, and differences related to student characteristics, attitudes, and behavior. One of the major contextual variables considered will be the institution within which a course is conducted. The third display in Table 2-2 shows the basic 3 (modes) by 4 (colleges) design for this analysis.

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Table 2-1

Number of Students, by Course

Course	Period	Mode	Enrolled	Completed Post-Course Q
AT NJIT				
CIS 213	Fall	Online	17	9
CIS 213	Fall	Offline	20	12
CIS 213	Spring	Online	21	10
Math 305	Fall	Online	13	9
Math 305	Fall	Offline	22	19
Math 305	Spring	Online	27	23
Management (OSS471)	Fall	Mixed	28	23
Management (OSS471)	Fall	Offline	21	13
Management (OSS471)	Spring	Mixed	32	23
Management (OSS471)	Spring	Offline	26	20
AT UPSALA				
Intro Soc	Fall	Online	17	11
Intro Soc	Fall	Offline	19	18
Statistics	Fall	Online	14	12
Statistics	Fall	Offline	20	17
Statistics	Spring	Online	12	9
Organizational Communication	Fall	Mixed	12	6
Anthropology	Fall	Mixed	12	8
Writing Seminar	Fall	Mixed	18	12
Business French	Spring	Mixed	8	6
OTHER				
Connected Education	All Year	Online	43	11
Ontario Institute	Spring	Online	12	7

Table 2-2

QUASI-EXPERIMENTAL DESIGNS FOR ASSESSING DIFFERENCES IN OUTCOME BY MODE

Number of Students for Whom
Data are Available Shown in Cells

Design 1
COURSE BY MODE

COURSE	ONLINE	FTF
CIS 213	13	18
MATH 305	12	22
MANAGEMENT	28	24
INTRODUCTORY SOC	16	19
STATISTICS	11	15
TOTAL	80	98

Design 2
REPETITION OF ONLINE COURSES

COURSE	FALL	SPRING
CIS 213	13	19
MATH 305	12	24
MANAGEMENT	28	30
STATISTICS	11	11
TOTAL	64	84

Design 3
SCHOOL BY MODE

	ONLINE	MIXED	FTF	TOTAL
UPSALA	41	38	26	105
NJIT	71	58	63	192
CONNECT-ED	13			13
OISE	7			7
TOTAL	132	96	89	315

EVALUATION INSTRUMENTS AND PROCEDURES

Data collection and analysis is being conducted under "protection of human subjects" guidelines, whereby all participating students are informed of the goals and procedures followed in the project and confidentiality of the data is protected. A variety of methods is being used for data collection, including questionnaires for students, automatic monitoring of online activity, participant observation in the online conferences, use of available data such as grade distributions or test scores for participating students, descriptive case reports by the instructor for each course, and a small number of personal interviews.

Questionnaires

Pre-and post-course questionnaires completed by students are the most important data source. (See Appendix). The pre-course questionnaire measures student characteristics and expectations. The post-course questionnaire focuses on detailed evaluations of the effectiveness of the online course or course segments, and on student perceptions of the ways in which the Virtual Classroom is better or worse than the Traditional Classroom.

The pre-course questionnaire was administered and collected at the beginning of the first "training" session in which the EIES use comprised or supplemented the instructional delivery mode. For Connected Education students and OISE students, the pre-course questionnaire was included with the mailed system documentation, with immediate return requested.

Post-course questionnaires were mailed to online students one week prior to the final examination. They were asked to bring the completed questionnaires to the final exam. The instructor collected each questionnaire as the final exam was handed to each student. If the questionnaire was not completed, the instructor handed a new one to the student and asked her/him to complete it after finishing the exam. Students were told that they could stay extra time if necessary to complete the questionnaire. If a student refused to complete a questionnaire, this was his or her right under the protection of human subjects regulations, and did not affect the course grade in any way.

For courses in "mixed" mode, the post-course questionnaire was distributed and collected in class, towards the end of the semester. A mailing with two follow-up requests was used for Connected Education students and for students who were absent during an in-class administration and session.

Measuring Course Effectiveness

The items used to measure students' subjective assessments of courses were included in the post-course questionnaire. They were developed on the basis of a review of the literature on teaching effectiveness, particularly Centra's (1982) summary. Copies of the available student rating instruments described in that book were obtained, and permission to use items from these standard questionnaires was requested. Effectiveness was conceptualized as being related to four dimensions: course content, characteristics of the teaching, course outcomes, and comparisons of process in the virtual and online formats. These dimensions are presented as separate sections in the post-course questionnaire, with the hope that the responding students might consider each dimension separately in their ratings.

Not all institutions were willing to give permission to use items from their teaching effectiveness instruments. Among those from whom permission to use items for measuring effectiveness were obtained and from which items were used are:

- Center for Research on Teaching and Learning, University of Michigan (Many items borrowed from their "catalog" of questions available for instructor- designed questionnaires).
- Evaluation and Examination Service, University of Iowa, Student Perceptions of Teaching (SPOT) test item pool (many items used or adapted).
- Endeavor Instructional Rating System, Evanston Ill. (a few items adapted).
- Instructor and Course Evaluation (ICE), Southern Illinois University at Carbondale (a few items adapted).

Almost all of these items from standard teaching effectiveness questionnaires suffer from the potential methodological problem of response bias. Likert-type items are worded positively, and the semantic differential type items are arranged so that the most positive response constantly occurs on the same side of the page. Though rewording for approximately half of the items was considered, it was decided to leave them in their original forms so that the results might be more directly comparable to those for other studies using the same items.

Course evaluations by students are admittedly a controversial means of measuring course outcomes. They have been observed to vary with many things in addition to teacher competence and student learning, such as an interaction between faculty status and class size (Hamilton, 1980). Student evaluations are strongly related to grades received in the course. There is argument about which is the cause and which is the effect. If grades are "objective" measurements of amount of learning, then we would expect that students with higher grades in a course would also subjectively report more positive outcomes. However, it may be that a student who has a good grade in a course rates that course and instructor positively as a kind of "halo effect" of being pleased with the course because of receiving a good grade. If the latter explanation were true, we would expect to see that student ratings on various dimensions are somewhat homogeneous and do not discriminate well among items measuring different aspects of the process or outcome (e.g., students with a D or F would rate everything about the course as poor, while students with an A would rate everything about a course as excellent.) Such distortions of teaching evaluations are probably more prevalent when the student raters know that their responses are being used as input for evaluating faculty in personnel decisions. In this case, the participants knew that their ratings were used only for this research project, and the ratings were made before final grades were received. Despite the limitations of subjective ratings, the students were probably in a better position than anyone else to report on the extent to which they had or had not experienced various positive or negative outcomes from a course.

Survey of Dropouts

All students who dropped an online course or who requested transfer to the traditional sections were surveyed with a special questionnaire designed for this purpose. The questionnaire probed the reasons for the action by the student and whether they constituted a "rejection" of the technology or other factors (see Appendix). Among these reasons might be dissatisfaction with the software or with response time; inadequate access to equipment; or reasons not related to the mode of delivery, such as personal problems, dislike for the subject matter in the course, or the work load required.

We had initially planned to have "dropouts" interviewed personally, either when the student saw an instructor about dropping a course, or shortly after. However, this proved not to be practical. Though official regulations say that students who are going to drop a course should see the instructor and/or that the registrar should inform an instructor promptly of drops, this in fact does not happen. Students "disappear" without formally dropping until the deadline for withdrawal, right before the end of the semester. They apparently also forge instructors' signatures on course withdrawal forms. In sum, our information on course withdrawals has proven to be so delayed that an immediate personal interview could not be conducted.

Dropouts who did not respond to the mailed questionnaire (with two mailed follow-ups) were contacted several times in order to try to interview them by telephone. They turned out to be very hard to reach; the Appendix includes the one telephone interview which we were able to obtain.

Automatic Monitoring of Use

We are using and refining software built into the current EIES system for measuring the amount and type of online activity by participants. A routine on EIES called CONFerence ANalysis (CONFAN) permits the tabulation and display of the number and percentage of lines and items contributed by each member of a conference, either for a specified part of the conference or for the entire conference. This automated analysis was run for each class conference. We will need to extend this capability in the future so that measures of participation in the "branches" can also be gathered and displayed. For this study branch responses were manually counted and included in the results of the CONFANS.

Monthly "billing group" data available for each member of a billing group during the previous calendar month were recorded for the following:

- Total number of conference comments contributed. This is not a complete measure of student activity related to the class, since it excludes contributions made in "branches" (which were numerous for some courses), or in notebooks or private messages. The latter is measured separately (see below).
- Total hours online.
- Total Number of Logins to the system.
- Total number of private messages sent.
- Number of different addressees for private messages sent during the last full month. This is a rough measure of the number of different communication partners with whom students are exchanging information online.

By recording these data monthly, we could aggregate to obtain the total for the whole course, and could also examine the extent to which these measures of activity changed during the course.

Other Types of Data

In addition to standard questionnaires, the monitored data on participation, and grades on tests and the final grade for the course, several other types of data were gathered.

Institutional Data

During the 1986-87 academic year, measures of general verbal and mathematical ability (the SAT's) and level of academic performance (the Grade Point Average) were obtained from college records for each student, if the student agreed and signed a formal release.

Feedback from Faculty

An online conference for faculty, messages exchanged with the project director, and two day-long face-to-face faculty workshops were used to exchange information about experiences conducting classes in the virtual classroom. Each faculty member also produced a description of their experiences in teaching online. This feedback from faculty, along with direct observation of the online classes, was used to generate the mostly qualitative data that served as the basis for the guide to teaching online included in Volume 2 of this report, and was also drawn upon for sections of this volume.

Interviews with Students

Personal or telephone interviews were conducted with ten students. Most of these students were selected from a list of 30 students who had given the most positive or the most negative ratings of VC on the post-course questionnaire, or who had dropped out and had not responded to the "dropout" questionnaire. A few "moderately negative" or "moderately positive" students were included in the personal interview sample in order to try to fill in the spectrum of reactions. The purpose of the interviews was to probe the reasons underlying the students' evaluations, and to explore the full context of experiences and circumstances which resulted in their opinions of the Virtual Classroom.

MEASURING THE VARIABLES

Many of the independent and dependent variables in this study are fairly simple and straightforward, such as age or gender, and were measured with single questions on the questionnaires. Others measure complex concepts, and were conceived from the beginning as composed of a number of dimensions, represented by a series of questions.

For all courses in all modes, a set of post-course questionnaire items was used to measure student perceptions of general characteristics of the course content, the quality of the instruction, and course outcomes. An additional extensive set of items was used to measure student perceptions of the nature and quality of the online courses as compared to traditional courses. The first two sets of dependent variables (items dealing with course content and quality of the teaching) will be treated only in terms of a combined index in this study, since they were not conceived of as being substantially influenced by mode of delivery. The two sets of variables measuring course outcomes and VC ratings will be treated both individually, and in combined indexes.

Constructing Indexes

Many of the conceptual constructs being used in this study are multi-dimensional. It is more valid to use several items, each measuring a slightly different aspect of the variable, and then combine them, rather than relying on one question. In building these indexes, items were included in the questionnaires that appeared to have "face validity." That is, conceptually, they appear to measure some attitude or behavior that is included in the concept. After the data were collected, these intended scales were subjected to an item analysis to see if they were indeed correlated. A reliability analysis was conducted, which computes Cronbach's Alpha as an overall measure of the reliability of the composite measure. In this procedure, (provided by SPSSX but not by SPSS-PC), each designated component is left out of the total index and the Alpha level computed for an index without the item included. In arriving at the final indexes, we omitted items that did not correlate well with the index as a whole, and/or items which substantially lowered the Alpha value if they were included.

Composite independent variables include the Personal Efficacy and Interpersonal Control scales devised by Paulus and Christie (1981) for measuring a person's perceived "sphere of control." Since the standard scale items and scoring were used, these scales are not included here; the items included can be seen in the Appendix, in the section of the pre-use questionnaire labelled "Images of Yourself."

The set of items on "current feelings about using computers" were combined into an index of "Computer Attitudes" (Table 2-3). The same items were repeated on the post-course questionnaire, with that index labelled as "Computer Attitudes-2." Similarly, the items on "expectations about the EIES system" were combined into an "EIES Expectations" index (See Table 2-4).

In the Computer Attitudes index, an item on perceived reliability of computers was originally included. It did not correlate well with the other items, and lowered the reliability of the scale, so it was omitted. Apparently, people who otherwise have positive attitudes towards computers may nevertheless feel that they are unreliable.

Indexes formed by combining items from the "course rating" and "instructor rating" portions of the post-course questionnaire are shown in Tables 2-5 and 2-6. Because all of these items were worded the same way on the questionnaires, with "1" or "strongly agree" the most positive response, and "5" or "strongly disagree" the most negative, scores were not reversed on any items in constructing the index. This does result in indexes for these two constructs for which the highest total scores correspond to the worst ratings. Key course rating questions with high inter-correlations, chosen from both the "Characteristics of the Course" and the "Course Outcomes" section, were included in the Course Rating index. All of the items on the instructor were included in the Instructor Rating Index.

Multiple items measuring the course outcomes of increased interest in the subject matter and increased ability to synthesize material were combined into INTEREST and SYNTHESIS indexes (see Table 2-7). The other items in the post-course questionnaire section on course outcomes were used individually.

One interesting point to note about the Collaboration Index (Table 2-8) is that we had initially included an item in the "individual vs. group learning" section of the questionnaire which had the student rate the degree of competitiveness among the students in the class. This item was not highly correlated with the other items that we thought indicate collaboration, such as making friends and working cooperatively. Apparently, collaborative work can proceed within a competitive environment. One can assume that what happens when a competitive situation is perceived is that the students collaborate to form a team that can compete more effectively than an individual.

Four of the items asking the students to directly compare the VC with the TC were used for a composite "VC OVERALL" index (Table 2-9). The item on preferring traditionally delivered courses was omitted because it was used only in the spring, and its inclusion lowered the number of cases too much.

Measuring Writing Improvement

All Upsala freshmen produce a "writing sample" in an examination setting upon entering the college. This is a response to an essay question. A different writing sample is then collected at the beginning of the Spring term.

Both "writing samples" are holistically graded by faculty members, who are trained in a "norming procedure" to consistently grade each essay as a whole on a 1 (totally incomprehensible) to 10 (excellent) scale. After norming with samples from each set of essays, two judges grade each student essay. If there is more than one point difference in the scores assigned, the essay is graded by a third judge. The two scores are averaged (or in the case of inconsistent ratings, the two most similar scores are averaged.)

Because of the nature of the norming procedure, it would be expected that the overall distribution of scores assigned in the Spring, after the Freshman writing course has been completed by students, would not be very different from that in the fall; in both cases, the students were being compared to one another. However, if the techniques used in one particular section of the course are more effective than those used in others, then there ought to be a difference in the amount of change in scores, with the scores in the more effective section showing more improvement than average. It was planned to compare change in writing scores for the section that used VC with that in the approximately 14 other sections.

Table 2-3

ITEMS IN THE COMPUTER ATTITUDES INDEX

For each of the following pairs of words, please circle the response that is closest to your CURRENT FEELINGS ABOUT USING COMPUTERS. For instance, for the first pair of words, if you feel computer systems in general are completely "stimulating" to use and not at all "dull," circle "1"; "4" means that you are undecided or neutral or think they are equally likely to be stimulating or dull; "3" means you feel that they are slightly more stimulating than dull, etc.

									X	SD
DULL-1 [R]										
Stimulating	1	2	3	4	5	6	7	Dull		
	23%	24%	21%	21%	5%	2%	3%		2.8	1.5
DREARY-1 [R]										
Fun	1	2	3	4	5	6	7	Dreary		
	22%	27%	23%	15%	8%	2%	3%		2.7	1.5
DIFFICULT-1 [R]										
Easy	1	2	3	4	5	6	7	Difficult		
	7%	15%	18%	27%	16%	12%	5%		3.8	1.6
IMPERSONAL-1 [R]										
Personal	1	2	3	4	5	6	7	Impersonal		
	6%	10%	13%	36%	11%	13%	11%		4.2	1.6
HELPFUL-1										
Hindering	1	2	3	4	5	6	7	Helpful		
	4%	2%	5%	15%	16%	31%	27%		5.4	1.6
UNTHREATENING-1										
Threatening	1	2	3	4	5	6	7	Unthreatening		
	4%	6%	6%	26%	12%	21%	26%		5.0	1.7
INEFFICIENT-1 [R]										
Efficient	1	2	3	4	5	6	7	Inefficient		
	38%	30%	15%	10%	2%	2%	2%		2.2	1.4
OBLIGING-1										
Demanding	1	2	3	4	5	6	7	Obliging		
	12%	12%	13%	40%	11%	8%	4%		3.6	1.5
UNDESIRABLE-1 [R]										
Desirable	1	2	3	4	5	6	7	Undesirable		
	25%	26%	16%	23%	3%	3%	4%		2.8	1.6

Notes: [R] indicates item was reversed for scoring
Range = 7 (least favorable) to 70 (most favorable)
Alpha= .82

Table 2-4

Items Comprising the "EIES Expectations" Index

Indicate your expectations about how it will be to use this system by circling the number which best indicates where your feelings lie on the scales below.

EASY-1

4%	6%	14%	25%	19%	20%	11%
1	2	3	4	5	6	7
Hard to learn						Easy to learn

(Mean=4.5, Std Dev= 1.6)

FRIENDLY-1

4%	7%	8%	24%	28%	20%	9%
1	2	3	4	5	6	7
Impersonal						Friendly

(Mean= 4.6, Std Dev= 1.5)

NOT FRUSTRATING-1

4%	10%	16%	24%	21%	21%	9%
1	2	3	4	5	6	7
Frustrating						Not frustrating

(Mean= 4.3, Std Dev= 1.6)

PRODUCTIVE-1

2%	1%	5%	18%	24%	34%	16%
1	2	3	4	5	6	7
Unproductive						Productive

(Mean= 5.3 Std Dev= 1.3)

EFFICIENCY-1 [R]

Do you expect that use of the System will increase the efficiency of your education (the quantity of work that you can complete in a given time)?

19%	21%	14%	24%	15%	5%	2%
1	2	3	4	5	6	7
Definitely yes			Unsure			Definitely not

(Mean=3.2 Std Dev= 1.6)

QUALITY-1 [R]

Do you expect that use of the System will increase the quality of your education?

21%	22%	18%	25%	6%	4%	3%
1	2	3	4	5	6	7
Definitely yes			Unsure			Definitely not

(Mean= 3.0 Std Dev= 1.6)

RESENT-1
I resent being required to use EIES for this course.

4%	3%	6%	19%	7%	17%	43%
1	2	3	4	5	6	7
Definitely yes			Unsure			Definitely not

(Mean= 5.5 Std Dev= 1.7)

OVERALL-1 [R]
Overall, how useful do you expect the System to be for online classes?

23%	27%	20%	19%	6%	3%	2%
1	2	3	4	5	6	7
Very Useful						Not useful at all

(Mean= 2.8 Std Dev= 1.5)

EXPECTED TIME

While you are part of an online course, how much time in the average week do you foresee yourself using EIES in relation to your coursework?

(1) 4% Less than 30 minutes
(2) 12% 30 minutes to 1 hour
(3) 43% 1 - 3 hours
(4) 29% 4 - 6 hours
(5) 7% 7 - 9 hours
(6) 5% 10 hours or more

Notes: Range = 9 (worst expectations) to 62 (highest)
Cronbach's Alpha= .82

Table 2-5
ITEMS INCLUDED IN THE COURSE RATING INDEX

WASTE OF TIME (R)
This course was a waste of time SA A N D SD

COURSE OVERALL
How would you rate this course over-all?

(1)Excellent (2)Very good (3)Good (4)Fair (5)Poor

MORE INTERESTED
I became more interested in the subject SA A N D SD

LEARNED FACTS
I learned a great deal of factual material SA A N D SD

CONCEPTS
I gained a good understanding of basic concepts SA A N D SD

CENTRAL ISSUES
I learned to identify central issues in this field SA A N D SD

COMMUNICATED CLEARLY
I developed the ability to communicate clearly about this subject SA A N D SD

(R) INDICATES ITEM WAS REVERSED FOR SCORING

RANGE= 7 (BEST) TO 35 (WORST)

ALPHA= .88

Table 2-6
THE INSTRUCTOR RATING INDEX

WELL ORGANIZED Instructor organized the course well	SA	A	N	D	SD
GRADING FAIR Grading was fair and impartial	SA	A	N	D	SD
ENJOYS TEACHING Instructor seems to enjoy teaching	SA	A	N	D	SD
LACKS KNOWLEDGE (R) Instructor lacks sufficient knowledge about this subject area	SA	A	N	D	SD
IDEAS ENCOURAGED Students were encouraged to express ideas	SA	A	N	D	SD
PRESENTED CLEARLY Instructor presented material clearly and summarized main points	SA	A	N	D	SD
OTHER VIEWS Instructor discussed points of view other than her/his own	SA	A	N	D	SD
PERSONAL HELP The student was able to get personal help in this course	SA	A	N	D	SD
INSTRUCTOR BORING (R) Instructor presented material in a boring manner	SA	A	N	D	SD
HELPFUL CRITIQUE Instructor critiqued my work in a constructive and helpful way	SA	A	N	D	SD

TEACHER OVERALL
Overall, I would rate this teacher as

(1)Excellent (2)Very good (3)Good (4)Fair (5)Poor

(R) indicates item scoring was reversed for the scale

Range= 11 (best) to 55 (worst)
Alpha= .88

Table 2-7
Components of the INTEREST and SYNTHESIS Indexes

Index of Increased INTEREST in the Subject

MORE INTERESTED [R] I became more interested in the subject	SA	A	N	D	SD
DID ADDITIONAL READING [R] I was stimulated to do additional reading	SA	A	N	D	SD
DISCUSS OUTSIDE [R] I was stimulated to discuss related topics outside of class	SA	A	N	D	SD

[R] indicates response values reversed for index scoring
Range= 3 (least interest stimulated) to 15
Alpha= .66

Items Included in the SYNTHESIS Index

CENTRAL ISSUES [R] I learned to identify central issues in this field	SA	A	N	D	SD
GENERALIZATIONS [R] My ability to integrate facts and develop generalizations improved	SA	A	N	D	SD
RELATIONSHIPS [R] I learned to see relationships between important topics and ideas	SA	A	N	D	SD

Range= 3 (low synthesis) to 15
Alpha= .80

Table 2-8
ITEMS COMPRISING THE "COLLABORATION" INDEX

I developed new friendships in this class [R]	SA	A	N	D	SD
I learned to value other points of view [R]	SA	A	N	D	SD

Individual vs. Group Learning

Some courses are essentially a very INDIVIDUAL experience; contact with other students does not play an important part in your learning. In other courses, communication with other students plays a dominant role. For THIS COURSE, please circle the number below that seems to be what you experienced.

1	2	3	4	5	6
Individual experience					Group experience

The help I got from other students was--- [R]

1	2	3	4	5	6
Crucially important to me					Useless or misleading

Students in my class tended to be

1	2	3	4	5	6
Not at all cooperative					Extremely cooperative

How often did you communicate with other students outside of class, by computer, "face-to-face" or on the telephone?

1	2	3	4	5	6
Never					Constantly

Items marked R reversed for scoring
Range =6 (least collaboration) to 34 (most collaboration)
Alpha= .74

Table 2-9
ITEMS COMPRISING THE "VC OVERALL" INDEX

INCREASE QUALITY (R)
Did use of the System increase the quality of your education?

: 1 :	2 :	3 :	4 :	5 :	6 :	7 :
Definitely yes			Unsure			Definitely not

NOT CHOOSE ANOTHER
I would NOT choose to take another online course.

: 1 :	2 :	3 :	4 :	5 :	6 :	7 :
Strongly Agree						Strongly Disagree

BETTER LEARNING (R)
I found the course to be a better learning experience than normal face-to-face courses.

: 1 :	2 :	3 :	4 :	5 :	6 :	7 :
Strongly Agree						Strongly Disagree

LEARNED MORE (R)
I learned a great deal more because of the use of EIES.

: 1 :	2 :	3 :	4 :	5 :	6 :	7 :
Strongly Agree						Strongly Disagree

(R) INDICATES ITEM WAS REVERSED FOR SCORING
RANGE = 4 (WORST) TO 28 (BEST)
ALPHA= .85

DATA ANALYSIS PLANS

Variations by Mode and by Course

As described previously, a quasi-experimental factorial design varying mode of delivery for five courses is at the heart of the design of this study. This basic design is supplemented by data collection on several other courses under various delivery modes, in order to increase the number of subjects for analysis and the related probability of obtaining statistically significant results.

After obtaining univariate data on all independent, intervening, and dependent variables, each will first be analyzed using a one-way analysis of variance by mode, and separate analyses of variance by course and by "school" (Upsala vs. NJIT).

Bivariate correlations will be obtained for each independent or intervening variable vs. each dependent variable, for all VC students, for all students in traditional sections, and for all students combined.

The next step will be a series of two-way analysis of variance('anova') procedures to look for interaction: course by mode; course by first vs. second offering online; and mode by school. For these analyses, which will have very unequal N's and missing groups, we will use the SAS "General Linear Models" analysis of variance, which provides tests of hypotheses for the effects of a linear model regardless of the number of missing cells or the extent of uneven distribution of subjects (see User's Guide: Statistics, 1982, SAS Institute).

Multivariate Analysis

We are particularly interested in trying to untangle "cause and effect" with an experimental design that does not randomly assign subjects to treatments, and in which differences in treatments (modes) may be confounded with other differences that are associated with educational outcomes. For instance, if we observe that there are differences among courses in such characteristics of students as previous Grade Point Average and SAT scores, which are measures of ability, and if the courses are also delivered in different modes, statistical methods can be used to pull out the relative importance of these factors.

For each of the dependent variables or combined indexes of primary interest, we will select variables for multiple regression, based on observed significant bivariate relationships.
We may also try introducing covariates into ANOVA's of course by mode.

SUMMARY

A dualistic evalution plan uses a quasi-experimental design to examine the issue of statistically significant differences in outcomes which are related to mode of delivery as it interacts with other variables. The research plan also utilizes qualitative methods, including course reports by instructor and interviews with students, to explore in depth the behavior and attitudes which underlie these statistics, particulary for especially excellent and especially poor outcomes.

The core quasi-experimental design employs matched sections of four courses, one section conducted totally in the Virtual Classroom environment, and one section conducted totally in the Traditional Classroom environment. This yields a basic 2 (mode) by 4 (courses) design. In order to obtain a much larger sample of students and a broader range of applications for both statistical and qualitative analysis, the design of the study was expanded in many ways. We added courses offered in a "mixed" mode, partially (at least 25%) VC and partially TC. We included post-graduate courses offered by three educational institutions to remote students, for which there is no "control" section meeting face-to-face. We also repeated several of the online courses a second time.

Data collection methods included pre-and post-course questionnaires, motitor data for online activity, test scores and course grades, participant observation, instructor case reports, and interviews with students. Questionnaire items measuring subjective assessments of course effectiveness were drawn from widely-used instruments for measuring teaching effectiveness. Many of the dependent variables are multi-dimensional; indexes constructed for these variables combine the answers to several related items from the post-course questionnaire.

CHAPTER 3

IMPLEMENTATION PROBLEMS

Before reporting the results of this project, it is necessary to provide the context for these results. We will describe some of the problems which arose in implementing the Virtual Classroom for totally online delivery of undergraduate courses for credit, for the first time. As should be expected, Murphy's Law reigned supreme. Particularly during the first semester, when the quasi-experimental design of matched online and face-to-face classes was carried out, there were many problems which deleteriously affected the online courses. In subsequent semesters, many of the problems were lessened, if not solved, and the results began to improve.

One implication of our experiences is that other institutions should "start small." That is, start with only one or two courses online, and build from there. With a fall semester set of offerings that included eight different completely or partially online courses and five "control" classes, spread over two campuses, we found ourselves in the situation of being unable to deal adequately with all of the minor crises and glitches that occurred.

Recruiting and Enrolling Students

The ideal student for the Virtual Classroom would be mature in terms of motivations about learning (seeking to learn as much as possible rather than to do as little work as possible); informed about the characteristics of this mode of delivery; and the owner of a PC and modem at home (in order to maximize their access). The ideal faculty member at an institution offering such courses would be informed about the advantages and disadvantages of VC delivery in order to advise prospective students, and supportive of a new means to deliver education to students who might benefit from it. The ideal university bureaucracy would be flexible and have good internal communications, so that steps could be taken to assure ease of implementing an enrollment decision by a student once that occured. In fact, students, faculty, and administrators are likely to be resistant, if not resentful or hostile, towards such an educational innovation, which they may perceive as a threat or an imposition.

In the Spring of 1986, a full-page description of the Virtual Classroom experiment was developed. The plan was to include it as a page in registration materials at Upsala and NJIT, and to footnote VC courses with references to this information. The information included a provision that the student must speak to the faculty member in charge of the course to review the consent form, and sign and turn in such a consent form in order to register for the course. This information page was included with Upsala registration materials, which is provided to about 2000 students each semester.

At NJIT, because of the expense, it was ruled that this full page of information could not be included in the registration information that was sent to thousands of enrolled and prospective students. Instead, each VC course carried two lines, "experimental course delivered via computer; see instructor for information." However, the campus newspaper carried the full information as a "front page" article. The registrar's office stated that procedures would be developed to make sure that students did not register for the course without a signed consent form.

By August, pre-enrollment figures were dismal at both schools. There was one student enrolled for Introduction to Sociology at Upsala; three for Introduction to Computer Science at NJIT. By erecting barriers to enrollment, even potentially interested students were discouraged. These barriers were inadvertently quite effective at NJIT. We discovered this when students who had intended to enroll in a VC section told the instructors that they had been informed that the VC section was closed, so they had enrolled in another section instead. Investigation of this mystery revealed that the registrar had decided to handle the consent form in the following manner. Capacity for the course had been set at zero; therefore, when a student tried to register, she or he would be told that the section was closed and that they would have to see the instructor for permission to register. However, the assistants actually present at registration did not know the special circumstances for why the computer was showing the sections as "closed." They simply told prospective students that the section was closed. As soon as this situation was discovered, the capacity was reset at 30, with the result that students began registering without understanding what it was that they were registering for. They simply would not take the trouble to seek out the instructor, as suggested in the registration material. Since instructors have only a few office hours a week, and students usually allocate just an hour or two to register for a semester, this is quite understandable.

When the dismal enrollment situation was discovered in August, posters and flyers were prepared and distributed on both campuses. The poster listed all VC sections and had a pocket for the flyers. There was a separate flyer for each course, with other VC courses available listed on the flyer also. The color was bright yellow. The posters were put near registration areas, in classroom buildings, and in bookstores and dormitories.

In addition, at Upsala registration, the project director visited each faculty member advising students, explained the project, distributed brochures, and made a plea for them to "advise in" students who might benefit from this approach.

The result was adequate numbers of students registered, but in many cases, these students were either totally ignorant of the experimental nature of the mode of delivery (having simply registered for an open section, without bothering to find out or perhaps even to notice the statement about "delivered via computer"); or unsuited for this mode of delivery. For instance, a number of the students registered in the online section of Introduction to Sociology were ice hockey players. The project director advised two of these players when they attempted to register. The ice hockey players reported that their team met in the chapel basement, which was also the location for registration. They saw the poster and flyers there. Their coach took it as a way out of a scheduling dilemma. It seems that the team could only "get the ice" for practice from 1 pm until 4 pm-- five days a week. It was impossible for most students to find a full schedule of classes within these limitations, since they also could not take classes at night, when games were scheduled. The coach noticed from the posters and flyers that the VC section did not meet at any specified time, and therefore would not conflict with other courses, and advised any player who needed another course to sign up for it. These students had come to college largely to play hockey rather than for academic reasons; they basically had no interest in Sociology but simply "needed a course;" and they attended other classes in the mornings and then went straight to hockey practice. After attending the initial training session, most of them signed on little or not at all.

Soliciting in the Chapel- Advertising and recruiting students for specific courses is simply not done in academia. Thus, our posters and flyers and personal communications were considered "unfair competition" by many faculty members. On both campuses, outrage was expressed at the means used to recruit students for the VC sections.

At Upsala, the Project Director was accused in a meeting of the Educational Policies Council of "soliciting students-- in the chapel, no less." Questions were raised about the project's being illegal (in the sense of not following college regulations for course approvals) and unwise. Many members of the EPC felt that anything delivered via computer could not be as effective as a traditional course, and that educational quality was being endangered. Though in the past, EPC approval had been required only to introduce a new course, many members felt that this means of teaching was so radically different from their concept of "teaching" that approval should have been sought in order for the experiment to be offered. These same members indicated that they probably would not have given such approval. Though the Dean's approval for the project had been secured, their reaction was that the Dean should not have approved the project and should have brought it to them for approval.

During the same week in September, the project director received an irate call from a representative of the Organizational and Social Sciences department at NJIT. This department offers Introduction to Sociology at NJIT. They had been asked if they would offer one section online, but had declined. Upsala and NJIT have cross-registration agreements, whereby a student at either school can register for a course at the other. On all of the course brochures, other VC sections were listed. Therefore, for instance, Upsala students were informed that they could register for Introduction to Computer Science online, and NJIT students were informed that Introduction to Sociology, offered by Upsala, was available to them.

The OSS representative was angry and outraged, and implied that we could be stealing their students. This was unfair competition. Moreover they had not approved the course offered by Upsala for credit at NJIT.

I explained that any NJIT student who tried to enroll for the Upsala course would have been required to check with his advisor and obtain approval for this course before enrolling. In fact, no NJIT student had requested enrollment. This latter fact mollified the OSS faculty member. However, he indicated that he felt that the approval of the OSS department should have been sought ahead of time, before listing this course as available to NJIT students; and that it was very, very unlikely that such approval would have been given.

Despite the publicity that so roused the ire of faculty members on both campuses, many students showed up at the first VC session for many of the courses with no idea what they had signed up for. This theme comes out in several of the interviews with students included in the Appendix, particularly for students who felt negatively about the means of delivery. They simply did not see the material included in the registration information or the posters and flyers and newspaper articles available throughout the school. Though they were offered the oppurtunity to transfer to another section, they generally stated that the alternative section was scheduled at an inconvenient time. They started their training with a negative and resentful frame of mind... and in many cases, their attitudes slid downhill from there. Since they were surprised and/or angry during the training session, they did not even hear some of the relevant information. For instance, all training sessions included a discussion of where and how to obtain a modem and a special telephone line, if they had a PC at home but no modem. Students who were "inadvertent enrollees" tended not to hear or to remember having heard this information.

Inadequate Equipment

Computer-Mediated Communication depends on many different pieces of equipment; if any one of them fails, the student is "shut out" of the "classroom." There is the central conferencing system itself, which may have hardware or software failures; its communications hardware and software for accepting incoming traffic from various sources; the telephone lines and/or packet network system through which the user reaches the system; and the micro, modem, communications software, and printer at the user's end. Our implementation was severely inadequate in terms of providing sufficient equipment at the user's end, and we also had some serious limitations with EIES.

Ideally, every student taking a course partially or completely online would have a micro and a modem at home and/or at work, and could dial in anytime. At the very least, there should be adequate access to high-quality and compatible equipment on a campus offering such courses. Such was not the case, particularly at Upsala.

Practically no Upsala students had microcomputers. On campus, there was a motley and inadequate collection of equipment. We had anticipated a major donation to the project from IBM, but they pleaded a change in financial resources vs. needs for their own new facility for corporate technical training at Thornwood, New York, and reneged. In the Upsala microcomputer laboratory, there was one ideal piece of equipment--An IBM PC-XT with a hard disk, 1200 baud modem with Smartcom software, and 1200 baud printer that was reliable. We also had three Radio Shacks that had no hard disks and completely different communications software; plus a shared printer for all three that only operated at 300 baud. There were three Apples with modems; they had still different communications software. Moreover, the apple configuration did not support continuous printing while online; the user had to continuously print one screen at a time. In addition there were a few 300 baud 'dumb' printing terminals spread around the campus; access procedures using this equipment were different than those required for use of the microcomputers, which further confused the students.

To make matters worse, the operating budget of the Upsala microlab was such that it could only stay open about 50 hours a week, instead of a desirable minimum of 12 hours a day, six days a week. The result was that many students found it very difficult to match their need to use equipment to 'attend' their classes with the limited opportunities available. As will be seen from data presented later in this report, the Upsala students did not spend a great deal of time online-- at least partially because access was so inadequate. (These access difficulties are described in more detail in Bob Meinke's report on the Introductory Sociology course at Upsala, in the appendix to volume 2)

At NJIT, freshmen and sophomores had been issued their own PC's. However, they were not issued modems or printers, and many were not willing to buy them for this course. In the Virtual Classroom laboratory at NJIT, there were only seven micros, and only one of these with an attached printer. Students without micros at home needed to use an awkward and time-consuming "remote print" facility to get printouts. In the regular microcomputer laboratories, the administration refused to provide connections to EIES. Their statement was that the labs were already overcrowded, and they did not have the facilities to add connections to the local area network for these machines. Thus, many of the NJIT students ended up on dumb CRT's placed in a big hallway, sending remote prints to a fast printer several floors below. This is hardly convenient or optimal access.

Problems reported by students who did had micros and modems at home included difficulties with tying up their phone lines for hours at a time, and with lack of adequate documentation for communications software. One of the best communications software packages, SMARTCOM, is expensive. Instead, students made use of a variety of "shareware" or inexpensive programs with less functionality. We could not even tell them how to use much of this software to connect to EIES, since we had never seen it ourselves.

Ideally, students should be supplied with a common piece of communications software, with the access numbers and parameters already set on their diskette. The shareware program "PROCOMM" is now available; if we had it to do over again, we would make diskettes of this software for all students with micros to use.

A related problem was with student assistants, who were supposed to be available to keep the labs open and to help online students. Many of them proved unreliable for various reasons. Their priorities were elsewhere. For instance, if they had an exam or an assignment due in a course, they just didn't show up for their hours, and students found locked doors on the microlab. One assistant at NJIT, who had been scheduled for 15 hours a week of the time the lab was to be open, went to Taiwan for one month in the fall and another in the Spring, because his parents died. Our project staff was so small that we had no "backup" personnel to cover consistently when such events occurred.

EIES itself is running on a minicomputer that is not very large or powerful by today's standards. It slows noticably when more than about 30 users are online simultaneously, which tended to occur during the initial training sessions and at midday on weekdays. It can accept only limited numbers of users coming in through each possible channel: local area network at NJIT, 300 baud local, 1200 baud local, and TELENET. The local area network access lines and/or the 1200 baud dialup lines were sometimes saturated during this experiment, forcing the students to try another access method or wait on a queue for a free line. In addition there was one serious crash during the fall semester, which came at the very worst time: during the last week of classes, when everything was "due." The EIES disks had filled up, and it took about two days to straighten out the mess and delete some unnecessary files. This was very frustrating and disruptive for the students, needless to say. (Note: We had been requesting additional storage capacity for over a year; the purchase order was not approved until its neccessity was demonstrated by the system coming to a complete halt. Such mechanisms for determining the true need for additional hardware resources are probably not unusual in universities, where there is competition for limited hardware budgets.)

Unfinished Software

For a variety of reasons that will not be described in detail here, the actual signing of the contract for this project did not occur until November of 1986; meanwhile, the project supposedly started in January 1986. The start of software development was postponed while the question of whether the whole project was a "go" or "no go" was at issue. As a result, the special software which we had intended to have completed fell about six months behind schedule. Only an incomplete and very "buggy" version of the branch activities was available at the beginning of the fall. The Personal TEIES graphics package was not completed until almost the end of the Spring.

Perhaps the decision should have been "no go." However, it was not possible to postpone the experiment, since academic offerings are scheduled an entire year in advance. The choice was to proceed with unfinished special software tools, or to cancel the entire project.

Resistance to Collaborative Learning

Most students are used to instructional designs that are based on either completely individual activity, or competition. The widespread practice of "grading on a curve" emphasizes competition and penalizes students for helping one another. When faced with an instructional design which calls for them to work with others in a cooperative or collaborative manner, particularly if they are expected to play a "teacher-like" role such as giving criticism of draft papers, many students are resistant. They may also feel that any grading scheme that makes their performance and grade dependent on collaborative work with others is "unfair." Finally, many students apparently place little value on the opinions of their peers.

This attitude of little regard for or interest in communication from other students was apparent among some students at the very first training session. When asked to practice using the system by entering comments for one another, they were impatient about reading material contributed by their peers, asked how to break the output, and wanted to know how to go straight to the assignments and lectures contributed by the instructor. If this attitude toward communicating with and working with their peers persisted, they were unlikely to feel positively about the Virtual Classroom approach.

Materials in Interviews 2 and 4 are relevant to this generalization. Note that the student in Interview 2 complains about VC being "self-study." When asked about his reactions to the contributions of the other students, he said, "I usually just blew off the other class members' comments and went straight to the professor's lecture. I wouldn't say that the other students' comments were a waste of my time; I just didn't read them."

Similarly, in Interview 3, a very negative student had no interest in even looking at material contributed by other students.

On the other hand, students who worked hard on collaborative assignments and then were "let down" by other group members also had very negative feelings, at the time. As a student in Organizational Communication who had finished her part of a group activity on time put it, "I don't think it's fair that those of us who worked so hard to get our information on the computer have to suffer for those who don't bother to get their assignments in on time!" A subsequent message assuring her that she would receive an "A" for her excellent and lengthy contribution did not make her feel a whole lot better about it. She messaged back about still feeling disappointed when she came to the lab looking forward to reading contributions by others, only to find that the "others" had not appeared. The students who were late completing their parts of an online collaborative activity were the same ones who were chronically late doing traditional individual handwritten or typewritten assignments. In the latter case, however, their tardiness did not interfere with the learning of other students, whereas in a collaborative online assignment, it did.

Another problem is getting students to offer constructive criticism to one another; this is an unfamiliar role. In the partially online writing course at Upsala, for instance, Mary Swigonski required each student in a writing group to respond to specific questions on on another's draft essays. On a particular writing exercise, they might have been asked to suggest a better opening, suggest a better organization, and to suggest a better closing. Each student was to use these comments to produce an improved final draft. Dr. Swigonski reports that in responding to these questions on each peer's essay, she could not get the students beyond "being nice" to one another. They felt comfortable saying what was good about the draft essay, but did not feel comfortable offering criticism. She encouraged the students to use pen names, but reports that they still did not feel comfortable making critical comments.

In future studies, the reasons for students' reluctance to offer constructive criticism to one another should be investigated with unstructured interviews focussed on this issue. Perhaps, for instance, students feel that their peers would be upset by critical remarks, even if offered in the context of suggestions for improvements. They may be reluctant to risk causing hurt or anger which would negatively affect their relationships with one another. Perhaps they feel unqualified to make such suggestions, especially in a "public" forum. Or, alternatively, they may feel that by helping one another out, they might be negatively affecting their own grade, if the class is graded on a curve. Finally, the observed problem may be related to student grade-oriented motivations. In the Upsala writing course, students were required to say something about each peer's draft essay in the small writing groups. However, they were not graded for the quality of their suggestions. In many courses, instructors have observed that the students at these two colleges allocate their effort roughly in proportion to its importance for their grades. Since anything above "zero effort" counted the same, they may simply have taken the rational time-allocation choice of making the minimal effort needed to maximize their grades. If the reasons for the failure of students to offer constructive criticism on drafts are understood, then it may be possible to change the social dynamics in future online classes.

Electronic Pranks

For some students, CMC represents a fascinating opportunity for mischief, minor and major. It is inevitable that students will be tempted to abuse the medium.

As Keenan (1987) points out, on the public and private BBS systems, some people are posting information that goes beyond the obscene and annoying and becomes truly dangerous and/or criminal. For instance, a BBS allegedly operated by a Ku Klux Klan chapter gives the names, addresses, and license plate numbers of KKK "enemies," including rabbis and suspected FBI agents. A BBS in Calgary contained plans for causing the city's Light Rail Transit train to crash; other entries have included things from directions for making an atom bomb or drugs to credit card numbers and instructions for "phone freaking."

Nothing quite this dire happened during the Virtual Classroom experiment. Students were warned orally and in one of the first messages they received that irresponsible behavior would result in loss of their accounts, just as disruptive behavior in a traditional classroom would result in their being asked to leave the class. They were specifically instructed not to send messages, anonymous or otherwise, to anyone who was not in their class and whom they did not know. Of course, some ignored this and sent personal and sometimes obscene messages to strangers they saw online. We have no idea how often this happened without complaint from the "victim," but in over half a dozen cases, there were complaints, and steps were taken to warn the offending student and/or to remove the account, depending on the severity of the breach of standards for acceptable student conduct.

Some students figured out how to steal an ID and use it to misbehave without much threat of exposure and punishment; they obtained other people's accounts from users who were careless about not protecting their passwords. In one case, several fraternity "brothers" of a sick student "helped him out" by signing online for him while he was in the hospital, and took the opportunity to send obscene messages to whatever females happened to be online at the time-- under their fraternity brother's name, of course.

Another student went this one better. He/she observed an instructor's password during a demo; the instructor evidently did not change his code after the demo. In the middle of the night, the perpetrator got online using the ID of the instructor; sent a series of extremely objectionable propositions to just about everybody online; and also posted several comments in public conferences, under the instructor's name, making scandalous remarks about the purported behavior of the President of the University. All of the latter were erased by the next morning; EIES users are for the most part a self-policing community. One of the recipients immediately sent a message of complaint about "Professor X's" message to the system monitor and user consultants; the system monitor then used his emergency privileges to delete all the conference comments and freeze the account. However, this should serve as an important cautionary tale for instructors and others. DO be careful to protect your access code! Use a temporary code for all demonstrations, and then change your access code immediately afterwards.

In sum, it is inevitable that the freedom and new opportunities for communication offered by CMC will be abused by some immature and/or irresponsible students. Policies must be developed which provide guidelines, and describe the consequences of unacceptable behavior online. These must be communicated clearly to the students, and enforced.

Relaxing Experimental Controls

The initial quasi-experimental design called for the "matched" sections of four courses to be "the same" in every way except that one section would be completely online (meeting face-to-face only for training, the midterm, and the final) and the other section would be completely face-to-face. They were to have the same content and the same assignments. The assumption that this could be done without cripling the potentials of the medium or raising ethical issues turned out to be incorrect. In fact, in all of target courses, adjustments had to be made.

Even before the semester started, the instructors pointed out that to require the same assignments in the matched sections would severely limit their ability to make use of the unique characteristics of the medium. The VC supports collaborative assignments and in-depth discussions, whereas the TC does not. So, though the offline reading assignments and the exams remained the same, the assignments given students were quite different for the two modes. This was true even for the Upsala statistics course, for instance, where the online section began with students filling out a questionnaire in the class conference, and then using the data provided by the other class members to carry out a statistical analysis. The offline section did this assignment using a pre-supplied data set.

The instructor for the NJIT statistics course found that many of the students wanted to work together in parallel, taking the opportunity to ask questions of her or the other students face-to-face, while working online. She scheduled a once a week, two-hour session when she was available in the NJIT microlab. About a third to a half of the class seemed to show up each week (unfortunately, we did not keep records of which ones). Generally, there would be periods of one or two students working silently at each of the terminals in the lab; periods where subgroups would be in animated discussion around a terminal, pointing at the screen; and short periods when several or all of them were conferring with the instructor about a question raised by the online material. We had not anticipated this "group lab" adaptation of the medium, but the instructor felt that it worked well for her and her students.

In computer science, the instructor found that the students could read through and understand the written version of his lecture material in a much shorter time than was required to cover the same material by talking and listening and taking notes. Therefore, he supplemented the online section by adding some additional activities and material which was not included in his traditional section.

In Sociology, the online assignments were totally different than those for the matched face-to-face section. These online assignments involved role playing and discussions. However, the midterm exam was based mainly on the textbook. There were many more failures on the midterm in the online section. The instructor felt that perhaps this was not fair to the students, since they had been tested on material which was not similar to the assignments they had been doing. Therefore, two optional face-to-face exam review sessions were held, and those who attended were given the opportunity to retake the midterm. This incident underscores the impossibility of complete "matching." The two media are suited to very different types of learning and assignments, and it does not make sense to try to test the students using the same examination. Nevertheless, we stuck rigidly with the use of the same midterm and final in all courses for this study.

Summary

The implementation of Virtual Classroom was far from optimal. Problems included:

- .Recruiting sufficient numbers of students for the experimental online sections.
- .Opposition from faculty members who believed that the medium would fail to adequately deliver college-level courses, and/or that it would be unfair competition which would decrease enrollments in their courses.
- .Failure to adequately inform all students enrolled in the experimental sections of the nature of the educational experience in which they would be involved, despite explanations in registration material, campus newspaper articles, flyers and posters.
- .Inadequate amounts and quality of equipment for student access.
- .Limited capacity of the central host (EIES), which was sometimes saturated.
- .Unfinished software tools to support the Virtual Classroom, including the absence of the graphics package that had been considered so important for some of the courses.
- .Resistance by some students to collaborative learning.
- .Deliberate misbehavior by some students.
- .Impossibility of rigid experimental control which "holds everything constant" except the medium of course delivery.

These problems interacted. For instance, we had initially anticipated only four courses involved in the experiment. Partially because of the low enrollments in the experimental sections, many other courses were added to the study. Each additional course had its own unique problems and demands, which added to the overload on the limited staff for the project. We were working under a contract that specified tight deadlines for completion of phases and "deliverables." It would have been far better to spread out the implementation over a longer period of time. However, the rigidity of the academic calendar and scheduling conventions (whereby courses and teaching assignments are scheduled as much as a year in advance) and of the project contract requirements made this impossible.

CHAPTER 4
WHAT HAPPENED IN THE VIRTUAL CLASSROOMS?

In this chapter, we will review the level of activity which occurred in the Virtual Classrooms and the students' ratings of and comments about their experiences. We will examine how the VC mode of delivery seems to have affected educational process and outcomes, on the "average" and as it varied among courses.

The Appendix includes data on the overall means and frequency distributions of responses to the pre- and post-course questionnaires. These results will be referred to in sections of this chapter. Rather than constantly repeating the full text of questions, each one has been given a short label, which also appears in the Appendix.

OVERALL (AVERAGE) VC RESULTS

Reasons for Taking a VC Course

For all students in all modes, among the most important motivations for enrolling in a course are that the course is required for graduation (56% reported this reason as "very important"), or required for a major (47%). Job-related interests or general interest in the topic also characterize a substantial number of enrollees (32%). In deciding whether to sign up for a traditional vs. a virtual classroom section, two additional motivations may come into play: curiousity about (or attraction to) the medium, and convenience.

There were significant differences among courses in the extent to which mode-related motivations characterized the students' reasons for taking a particular course and a particular section of a course. For the two "distance education" courses included in the study, greater convenience and curiousity about or attraction to the medium was a very strong factor (see Table 4-1. Distributions for partially online courses with no matching section were omitted, since these students had no choice of section or mode). These factors also played an important role for the totally online courses at NJIT. At Upsala, they were important for many or most of the students who enrolled in Sociology online, but not for the students in the statistics course.

Table 4-1
Reasons for Taking VC Courses
% Choosing "Very Important"

	Job	General Interest	Required Major	Required Grad	Instructor Reputation	No Choice	Curious	More Convenient
CIS213 Fall	54	54	31	25	8	0	54	71
CIS213 FTF	56	29	59	53	19	0		
CIS213 Spr	43	62	19	19	14	0	33	52
Math305 Fall	17	42	67	67	46	20	50	67
Math305 FTF	14	4	73	77	24	10		
Math305 Spr	33	50	62	70	29	8	56	42
OSS-Fall	32	14	57	64	4	0	19	12
OSS-FTF	50	42	83	74	4	10		
OSS-Spr	40	23	67	73	14	10	27	14
SOC-Fall	19	31	38	47	20	7	63	44
SOC-FTF	21	21	26	42	11	0		
STATS Fall	27	27	36	46	27	0	27	36
STATS FTF	13	27	27	53	40	0		
STATS Spr	0	8	27	58	33	9	33	9
CONNECT-ED	71	71	8	8	31	0	64	64
ONTARIO	42	25	8	25	0	0	75	58

CHI-Square = 66 $p = 0.01$

Sample Interaction in the Virtual Classroom

One way to begin to understand what happened in the Virtual Classroom is to look at a sample transcripts of parts of courses. Several excerpts are included as an Appendix to Volume 2 of this report. In this volume, we will include part of what happened during one week in Introductory Sociology, a course which illustrates many of the problems as well as many of the potentials of using the VC mode of course delivery.

There is a great deal of variation in perceptions of characteristics of the Virtual Classroom, both among courses and among students in the same course. However, some "central tendencies" include the following:

.Greater candor, among those who participate; and

.A tendency towards procrastination.

Both of these tendencies are illustrated in the Exhibit from a module in the Introductory Sociology course. The instructor reports that the students seemed to feel more at ease about revealing personal experiences in relating examples to apply and illustrate sociological comments. Certainly, many of the responses in the exhibit relate to very personal aspects of the students' lives. About half of the students chose to use their pen names, and the other half did not. The half that signed their assignments with their names do not seem any less candid than the half who used the privacy protection provided by a pen name.

Some of the entries are so poorly written that it is difficult to understand them. This should not be attributed to typing errors; many of the Basic Skills essays hand written by Freshmen show the same types of pervasive grammatical errors. As we will see later in this chapter, these students had fairly low levels of skill for college-level work, as measured by SAT scores and grade point averages for other courses.

The excerpts also show the tendency of students to put off assignments and other forms of online participation. The first assignment was due by Midnight on a Tuesday night. Several of the entries were made after dinner on that evening. Since the students did not have computers at home or in their dormatories, this meant that they had to make a special trip to a computer terminal in the evening.

The close times of several of the items suggest that the students were in fact in the laboratory together. It was a common practice for two or three students in an online course to develop a "buddy system" and sit next to each other and talk over things that were coming across the screen, and help one another with the mechanics of using the system or the contents of the material. Though this was supposedly not allowed during quizzes, it undoubtedly occured then too.

Exhibit

EXCERPTS FROM INTRODUCTION TO SOCIOLOGY

Note: Only minimal editing of student comments has been done, in order to preserve the tendency towards mistakes in grammar and spelling that pervade many of the entries. A name in quotes means that the student chose to enter a response with a pen name. Other names have been removed.
The instructor's comments have been greatly shortened, in order to give just the essence of the material to which the students were responding.

:C2039 CC148 Robert Meinke (Bob M,1571) 10/ 9/86 10:08 AM L:145
KEYS:/ROLE STRAIN/ASSIGNMENT #9/

(YOU MAY WANT TO MAKE A PRINTOUT OF THIS LONG MINLECTURE AND ASSIGNMENT)

Your text briefly discusses the topic of ROLE STRAIN. I would like to amplify that discussion because role strain is one of the most prevelant sources of discomfort in people's lives, probably also in yours.

ROLE STRAIN: The difficulty experienced by an individual in meeting the expectations of his or her roles.

Role strain has two major causes:

ROLE CONFLICT: Conflict due to incompatible demands of one's roles.

ROLE AMBIGUITY: Discomfort because what is expected of one in certain roles is not known or not clearly understood.

(over 100 lines of "minilecture" deleted here)

ROLE STRAIN: ASSIGNMENT #9

ENTER AS A CONFERENCE COMMENT. DUE: TUESDAY MIDNIGHT, 10/14. USE YOUR PEN NAME. USE KEY: ROLE STRAIN/ASSIGNMENT #9

1) Describe in detail an experience of real role strain that you have experienced sometime in your life.

2) In sociological terms, what was its cause? Was it due to:

a) role conflict
  -a role incompatible with your personality
  -conflict between the role demands of two different statuses
  -conflict between two roles in one role set
  -conflict between the demands within one single role
  -conflict with a role partner over the meaning of that role
b) role ambiguity
  -because the role was a new undefined role
  -because the expectancies of the role were rapidly changing
  -because you were entering a new life status which you didn't feel prepared for

3) How did you try to resolve the strain?

a) compartmentalization
b) hierarchy of obligations

c) banded together with others to change the social definition of the role
d) renegotiated the role definition
e) left the status
f) chose an emotional outlet to escape

:C2039 CC173 "MONIQUE" 10/13/86 11:31 AM L:18
KEYS:/ROLE STRAIN/ASSIGNMENT #9/

AN EXAMPLE OF ROLE STRAIN THAT I AM EXPERIENCING NOW IS BETWEEN SCHOOL AND WORK. I WORK FOR A MAJOR CORPORATION WHILE GOING TO SCHOOL FULL-TIME. HOWEVER, MY EXPLOYER WOULD LIKE ME TO PUT IN MORE HOURS THAN I DO NOW. THE STRAIN THAT I FEEL IS THAT I KNOW I NEED A FOUR- YEAR DEGREE TO ADVANCE IN THE COMPANY, YET THEY EXPECT ME TO WORK MORE WHILE IN COLLEGE. WITHOUT THE DEGREE, I WILL NEVER GET ANYWHERE IN THE COMPANY.

2) THE CAUSE OF THE ROLE STRAIN IS ROLE CONFLICT- CONFLICT WITHIN THE DEMANDS OF ONE SINGLE ROLE.

3) I TRIED TO ESTABLISH AN HIERARCHY OF OBLIGATIONS TO RESOLVE THE CONFLICT. I WILL NOT GO TO COLLEGE LESS THAN FULL-TIME, SO ALL OF MY SPARE TIME IS DEVOTED TO WORKING. THIS WAY I CAN GAIN WORK EXPERIENCE, AND, HOPEFULLY, BE HIRED AT A HIGH LEVEL AFTER I GET MY FOUR-YEAR DEGREE.

:C2039 CC177 "MONEY" 10/14/86 11:47 AM L:12
KEYS:/ROLE STRAIN/ ASSIGNMENT 9/

ONE EXPERIENCE OF ROLE STRAIN WAS AS AN EMPLOYEE OF UPSALA COLLEGE. THE PROBLEM WAS ROLE AMBUGUITY, I CAME INTO A JOB WHOSE DUTIES WERE NOT CLEARLY DEFINED. IT WAS ALSO AT THE TIME OF A CHANGE IN SUPERVISOR. I WAS HIRED BY AN ACTING DIRCTOR, BUT WHEN I REPORTED TO WORK, I FOUND A NEW DIRECTOR. THE JOB DESCRIPTION WAS NON-EXISTENT AND THE NEW DIRECTOR NEVER TOOK THE TIME TO DEVELOP ONE. I TRIED TO RESOLVE THE CONFLICT BY ESTABLISHING A HIERARCHY OF OBLIGATIONS, AND ALSO BY RENEGOTIATINGWITH MY SUPERVISOR WHAT THE ROLE SHOULD BE. I FINALLY LEFT THE POSITION FOR A MORE STABLE ONE.

:C2039 CC179 (Name, Nickname, ID) 10/14/86 1:48 PM L:24
KEYS:/ROLE STRAIN/ASSIGNMENT #9/

ONE OF THE MOST DIFFICULT ROLE STRAIN THAT I HAVE EXPEERIENCED IS WHAT IS EXPECTED OF A YOUNG WOMEN. THIS HAPPEN TO ME A COUPLE OF YEARS A GO. I REAL LY ENJOY RACKETS BALL AND MY MOTHER AND BOYFRIEND KNEW THIS. THEY DID NOT SEEM TO MIND ME PLAYING, BUT ONCE THEY FOUND OUT THAT I HAD JOIN A CLUB WHICH HAD RACKET BALL TOURNMENTS THE IDAL OF ME PLAYING WAS WRONG, AND I WAS CONSIDERED OUT OF PLACE. MY MOTHER SAID THAT IT LOOK BAD FOR A LADY PLAYING BALL WITH MEN,OR COMPETEING WITH MEN IN A SPORT. MY BOYFRIEND GAVE ME LITTLE TALKS ABOUT HOW UNLADY LIKE IT IS PLAYING AGAISTED MEN THEN HE TOLD ME THAT PRESPERATION DOES NOT HELP WOMEN BUT HINDER THEM. A THIS WAS A CONFICT OF ROLE,THE TYPE OF ROLE CONFLICT IS ROLE AMBIGUITY, HE AND MY MOTHER DID NOT WANT TO ACEPT THAT ROLE EXPECTANCISE ARE RAPID LY CHANING. 2 2)IN SOCIOLOGICAL TERMS,THE CAUSE WAS B) ROLE AMBIGUITY BECAUSE THE EXPECT ANCIES OF THE WERE RAPIDLY CHANING.3)I TRIED TO RESOLVE THE STRAIN BY RENEGOTIATED THE ROLE DEFINITION OF WHAT IS EXPECTED OF A YOUNG LADY.

:C2039 CC181 (Name,ENickname, ID) 10/14/86 8:04 PM L:16
KEYS:/ROLE STRAIN/

A DAUGHTER TO A MOTHER IS AN EXAMPLE OF ROLE STRAIN. DAUGHTER WHICH IS ME AS A TEENAGER GROWING INTO AN ADULT. I HAVE AN DIFFERENT OPINION ON THINGS THAT MY MOTHER CANNOT RELATE TOO. I GUESS THERE IS AN REBELLION STAGE WITHIN THE TEENAGE YEARS. MY MOTHER STATES HER OPINION AND EXPECTS ME TO AGREEE AS A GOOD DAUGHTER SHOULD DO. THIS CAUSES A GREAT CONFLICT.

HER ROLE OF A DAUGHTER IS ONE WHO LISTENS AND OBEYS TO WHATEVER SHE MAY SAY. 2.) THE CAUSE WAS DUE TO ROLE CONFLICT. A ROLE INCOMPATIBLE WITH MY PERSONALITY CONFLICT BETWEEN THE DEMANDS WITHIN ONE SINGLE ROLE AND CONFLICT WITH A ROLE PARTOVER THE MEANING OF THAT ROLE. 3.) I TRIED TO RESOLVE THIS STRAIN THROUGH RENEGOTIATION. I WOULD LISTEN TO HER OPINIONS AND TAKE THEM INTO CONSIDERATION BUT ALSO HAVE HER TO LISTEN TO MY OPINIONS AS WELL. WITH BOTH MAYBE WE COULD COME TO SOME REASONABLE RESULT. ;

:C2039 CC183 (Name,Nickname,ID) 10/14/86 8:26 PM L:8 KEYS:/ROLE STRAIN/ASS.#9/

1. I EXPERIENCED ROLE STRAIN WHEN MY MOM REMARRIED AND MY STEPFATHER -FATHER WAS INTRODUCED INTO MY HOME. I HAD TO ASSUME A NEW ROLE AS A STEP-DAUGHTER WHICH INCLUDED ASKING HIM FOR PERMISSION TO GO OUT OR TO USE THE CAR. ASKING FOR MONEY WHEN I OR MY MOM DIDN'T HAVE ANY,ETC. 2. IN SOCIALOGICAL TERMS MY ROLE STRAIN WAS CAUSED BY ROLE AMBIGUITY. 3. I RESOLVED THIS ROLE STRAIN BY RENEGOTIATING MY ROLE AS A STEP-DAUGHTER WITH MY STEP-FATHER. HE IS MY MOTHER'S HUSBAND AND I WILL GIVE HIM RESPECT FROM TIME TO TIME BUT THEN I WILL LOOK UPON HIM AS A FATHER IN CERTAIN SITUATIONS.

:C2039 CC184 (Name, Nickname,ID) 10/14/86 8:28 PM L:19
KEYS:/ROLE STRAIN/ASSIGNMENT#9/

I EXPERIENCED ROLE STRAIN WHEN I ENTERED BUCKNELL UNIVERSITY AS A FRESHMAN. I HAD NO PREVIOUS PROBLEMS IN ASSUMING THE ROLE AS A STUDENT IN HIGH SCHOOL (ROLES INCLUDED BEING SOCIABLE AND STUDIOUS, WHICH LEAD TO ACADEMIC ACHIEVEMENT), BUT I EXPERIENCE DIFFICULTY AT BUCKNELL BECAUSE I COULD NOT ASSIMILATE THE COLLEGE LIFE. AS A RESULT, I WAS UNABLE TO BE SOCIABLE, STUDIOUS, AND ACHIEVE ACADEMIC SUCCESS. MY GRADES, OF COURSE SUFFERED DRASTICALLY, AND I BEGAN TO FEEL SOCIALLY CONFINED. SUPPORT WAS NOT GIVEN TO ME BY OTHER STUDENTS AND BUCKNELL FACULTY. AS A STUDENT I WAS ENTITLED TO THIS SUPPORT.

ROLE AMBIGUITY CAUSED MY ROLE STRAIN, FOR I WAN NOT PROPERLY PREPARED FOR LIFE AS A COLLEGE STUDENT. I HAD NO FORMER EXPERIENCES TO RELY ON PREPARATION FOR THIS NEWLY ACQUIRED OR ACHIEVED STATUS.

I RESOLVED MY ROLE STRAIN BY LEAVING THIS STATUS. I DROPPED OUT OF COLLEGE AFTER THE FIRST SEMESTER OF MY SOPHOMORE YEAR VOWING NEVER TO RETURN TO SCHOOL, ESPECIALLY BUCKNELL UNIVERSITY. OBVIOUSLY, I DID NOT KEEP THIS VOW. I NOW FEEL THAT THE TWO YEARS I HAD TAKEN OFF FROM MY FORMAL EDUCATION HAS ENABLED ME TO MAKE A MORE MATURE APPROACH TO BEING A COLLEGE STUDENT.

Student Perceptions of the Virtual Classroom

In the following pages, we will summarize students' reactions to their VC experience across all courses that were offered totally or partially online. It must be kept in mind, however, that "average" responses and reactions are obtained by combining results for courses which varied a great deal.

Included in the Appendix are the complete distributions for responses to the post-use questionnaire on the items which asked all students who used the Virtual Classroom to compare their experiences to previous experiences in courses delivered entirely "face-to-face." These questions were 1 to 7 Lickert-type scales, with responses ranging from "strongly agree" to "strongly disagree." The responses from 1 to 3 were summed as indicating agreement, and those from 5 through 7 as indicating disagreement.

Convenience: The majority (65%) felt that taking online courses was more convenient. Even those students who generally prefer traditional courses tended to comment on the advantages of being able to work on the course at times of their own choosing. For instance, in the fifth interview in the Appendix, a student from the fall Statistics course at Upsala commented,

> I liked that I was independent and that I could go whenever I wanted to. And I like how the conferences were written down and I could get my notes. It also helps if you miss a day or two, because the computer always has your assignments there for you.

Those with computers and modems at home were of course, most likely to appreciate the convenience. For example, in the sixth interview in the Appendix, a Management Lab student said,

> It's also good because there is easy access whenever you

> want. I have a modem at home. I can go on at 3 o'clock in the morning. That's usually when I do most of my work.

Themes related to the greater convenience and comfort of attending class online also appear in the comments offered by students about what they "liked best" about the Virtual Classroom. "Being able to do the assignments at my own pace and not being obligated to sit in a very confined classroom;" "the freedom;" "being able to put the information into the computer whenever it is convenient;" "flexible class hours," and "not having to go to class" are some of the attributes mentioned.

More Work: The majority (63%) disagree that they "didn't have to work as hard for online classes." The fact that most felt that they worked much harder also comes out in the interviews with students and the course reports from instructors. However, it should be noted that the instructors did not unanimously agree with the student perceptions that they were working harder for online courses.

It is definitely true that the most enthusiastic students spent a great deal of time in their online courses. For example, a very positive student who participated in the Management Lab reports:

> I sign on every day. I usually spend about an hour; it depends how much other work I have. Sometimes as little as half an hour; sometimes two or three hours. Sometimes I sign on several times a day. I spend a lot of time online. I love it... I don't mind putting in the hours, the time just flies by.

Irregular Participation: Almost half (49%) admitted that when they became "busy" with other things, they were more likely to stop participating in an online course than to "cut" a traditional class. This is the flip side of self-pacing. Many students just did not have the self-discipline to stick to a regular, frequent schedule of signing online and working. For instance, see the second student interview in the Appendix. This student remarked, "I don't feel that I have the self discipline for it. I don't have enough time in my day as it is. To sit down and make myself do something like that..."

The students who did not participate regularly recognized that they were not able to get much out of the course by letting everything go until the last minute. For instance, a student who got a "D" in Computer Science got into the habit of staying late at work only one night a week to use the computer from there. He explains his apparent inability to make time for regular and leisurely participation in the course as follows, (from Interview 9):

> My downfall was in trying to minimize reading of the comments during the time I had to devote to it. I didn't read them on the screen, I printed them out and took them home. Then things would happen. I work long hours, I live alone and have to cook dinner.. I did look at a few of them... but I tried to do everything as fast as I could in order to maximize what I could finish during that one night. I tried to bring the paperwork home, but you bring home a book and often it does not happen... I read maybe 60% of it.

As a result, instructors began devising strategies to force frequent signon, such as weekly quizzes due on a different day than the assignment, or raising the proportion of the grades allocated to online participation. (See, for instance, the course narratives in the Appendix of Volume 2 by the instructors for Introductory Sociology, Computer Science, Statistics, and the Management Lab.)

Increased Interest, Involvement, and Motivation: For those who did participate, the level of interest and involvement tended to be high. 55% agreed that the fact that their comments would be read by other students increased their motivation. 62% disagreed that the Virtual Classroom was "more boring" than traditional classes, and 56% agreed that they felt more involved in taking an active part in the course. The word "fun" was frequently used by those students who reported high levels of interest and involvement.

Less Inhibition: The questionnaire item was worded negatively, in terms of feeling "more inhibited." 44% disagreed, and 29% perceived no difference between modes. This was obviously an aspect of online participation which varied a great deal among students and perhaps among courses, as a result of levels of writing skill, self-confidence, and the atmosphere established by the instructor.

Sociology Instructor Robert Meinke reports, in his course narrative, that

> Online courses do encourage students to write better responses to their assignments. The fact that other students will read what they have written often stimulates more effort. I also found that students seem to feel more at ease about revealing personal experiences. The options that EIES provides of sending anonymous or pen name responses encourages the more shy person to express him or herself more openly.

A Math 305 student (Interview 1) said that he felt "more free" to say things online:

> I may seem gregarious, but I'm pretty shy. It's easier from here. Because it seems like one-on-one.

Related to the general perception that the written word allows people to be somewhat more "free" in expressing themselves, is the feeling expressed by several students that the medium makes grading more "fair." A CIS student in interview 10 remarked:

> All he knows is what you type. He can't be prejudiced against you based on the way you look... It's more fair this way. You're being judged really on your work, not on your personality.

On the other hand, some students felt more inhibited, especially about asking questions that might expose them as "ignorant." While students might join in a discussion or a simulation, they were more reluctant to ask questions about the reading or a lecture. Some of this reluctance may be due to a false assumption that they might be penalized for a "stupid" question. The Upsala statistics student in Interview 3 explains

> Sometimes you don't feel comfortable asking the teacher questions through the computer. In class, you can raise your hand, or you can ask questions after class. It is not as comfortable to ask a question online, so you don't ask... Maybe he will take off credits or something. Sometimes it is too late to put a question in- the assignment is already due. It's more personal when you see the teacher.

Especially in the more technical courses, such as statistics and Computer Science, the instructors also experienced a difficulty in eliciting and responding to student questions and assignments online. For instance, Lincoln Brown explained the relative lack of instructor responses to student comments in his class conference as follows:

> Where students had problems, I sent them messages.
>
> While I plead guilty to not providing positive feedback, note that there's not much which can be said about many of their comments. For example, when simply asked to look at a graph and comment on which bar is higher, they all made some appropriate but innocuous comment.
>
> And look at the timing problem I mentioned in the report. I gave an assignment on March 27th; the first solution was entered on April 6th; most came in on April 15th (future taxpayers practicing with this deadline!) I had been collecting responses on paper as they came in, but didn't grade them or comment until after the due date (a mistake on my part.) In a few cases I believe I responded to each with a grade and a one-line comment via one of BJ's +quiz - related programs.
>
> I believe the whole idea of "comments" is fundamentally different in a math course and, say, a sociology course. Maybe Rose found it not to be so - I wish I had had time to follow her conference while mine was going on - but probably most of the time there will be this difference.

Increased Interaction: The majority of students (58%) felt that they had better access to their professor in the Virtual Classroom. This interaction was also more "friendly" and equalitarian than would be typical of the traditional classroom. For example, a Math 305 student said:

> She'll put a message in and say, "Have a great week..." Especially, if you have a message or a problem, she'll write back and say, "Hi there, how have you been? You have a problem with this..." It's really almost like talking on the phone. I try to send messages back the same way, real casual. It's not a strict teacher-student kind of thing. Because of her, you feel a lot closer, because it's so easy just to pop a question. She'll answer the next day, or whenever you come online. (Excerpt from "Interview 1" in the Appendix).

Opinion is more mixed about whether the Virtual Classroom led to more communication with other students in the class: 47% agreed, but 19% perceived no difference between delivery modes on this criterion, and 32% disagreed. On related items, 55% agreed that the fact that their work would be read by other students increased their motivation; 59% found the comments made by other students to be useful; and 62% found reading the reviews or assignments of other students to be useful.

Those who were most enthusiastic about the medium tended to value the contributions and comments of other students highly, and to enjoy reading them. Among the phrases that are used in describing what students "like best" about the Virtual Classroom (in response to the open-ended question on the post-course questionnaire), students mentioned "Class participation," "Being in touch with other students constantly," "Working as a group and extended communications online," and "the openness- I liked to hear other students' ideas." A Math 305 student reported (Interview 1) that the comments of other students were

> ...entertaining. Some of those people have some witty comments. That makes the class more interesting. If you find that there are a lot of comments, then you get online just to see them.

By contrast, a negative student in the same course commented, "I usually just blew off the other class members' comments and went straight to the professor's lectures." A negative student in the Upsala statistics course refused to read anything written by students, and referred to student contributions as "junk." A classmate in the same course reported, however,

> Most of the students who made comments were the ones who really understood the class and they were about the lectures. And they were pretty helpful, especially when the homework could be checked.

An Organizational Communication student commented as follows about the value of reading the comments of other students:

> I felt that they were really helpful. It gave me another perspective on what I was doing. If I did not see a point and they did, I was able to incorporate it into my thinking... It was really a good way of learning different ideas.

Inter-Item Correlations: We have reviewed responses to 11 questions asking students for comparisons between the traditional and Virtual Classroom environments. Only one of the 55 inter-item correlation coefficients was particularly high: finding the comments of other students useful and reading the assignments of other students correlated at .70. The other dimensions were clearly distinct in the students' minds, in the sense that response patterns were different. For example, the next highest coefficient was .57, between increased convenience and whether the VC was more boring. Thirteen of the coefficients were under .10. This suggests that the students did tend to read each of the statements carefully and responded to each one individually, rather than adopting an automatic "response set."

Overall Subjective Evaluations by Students

Use of the Virtual Classroom on EIES was more widely perceived as increasing educational quality (56% agreed and 22% saw no difference) as compared to traditional modes of delivery than as increasing educational efficiency (44% agreed, and another 23% saw no difference in "efficiency," at least with the current system and hardware access shortcomings). In terms of overall comparisons about whether the Virtual Classroom approach "provides a better learning experience than normal face-to-face courses," 47% agreed and 25% felt that it was neither better, overall, or worse; it was just different. Asked if they "learned a great deal more" using EIES than they would in a traditional course, 45% agreed and another 27% neither agreed nor disagreed. Perhaps this item should have been worded as simply "learned more" rather than "a great deal more," since the proper response for a person who learned a little more is not obvious.

However, on both these items and on the negatively worded items, there are about 20% of the students who definitely did not like the Virtual Classroom as well as the traditional classroom, as indicated by their choice of one of the two most negative points on the scales. In assessing the statement, "I would have gotten more out of a traditional course," 24% agreed and 56% disagreed. 26% agreed and 64% disagreed with the conclusion, "I would NOT choose to take another online course." Thus, the mean and median responses on overall assessments of the Virtual Classroom experience tended to be positive, but there was a sizable minority who did not like it as well as the traditional classroom. Much of the remainder of this report will be devoted to analyzing the effects of characteristics of students and other variables which help to explain the variations in assessments and outcomes.

Evidence on Dropouts

One of the most important behavioral indicators of dislike of the Virtual Classroom approach is the rate at which students drop courses offered via this mode, as compared to the dropout rate for similar courses offered offline. There definitely was a greater tendency towards dropout in VC sections. This seems to be related to the tendency of students with poor study habits and a lack of self-discipline to procrastinate, then realize that they are hopelessly far behind, and drop the course. (There may be a disproportionate tendency for students with many family and job obligations to elect a course via this medium in the first place, but this is only speculation).

Unfortunately, students who were not very reliable about completing their online work regularly and who dropped out of courses offered via this mode were also very elusive when we tried to get data from them. All "dropouts" were sent two copies of the special questionnaire prepared for them, with the second letter pleading the importance of having their responses. Only nine returned it; none from Upsala. All dropouts who did not return a questionnaire were called more for an interview. Only one could be contacted by phone; the others were never at home. Thus, the evidence we have is incomplete.

Table 4-2 shows the results for the nine dropouts who did respond to the questionnaire. Some of the reasons, such as "family problems" and "had a similar course already" are not related to mode of delivery. Of the nine, three would not choose to take another course via this mode. Two of the nine agreed that they "did not like the Virtual Classroom approach." On the whole, then, the reasons given by dropouts who responded tended not to be strongly critical of the medium, but instead reflected the types of reasons given for a decision to drop any course.

Table 4-2
Reasons Given for Dropping Virtual Classroom Courses

Question: How important were each of the following factors in your decision to drop the course?

Reason	Very Important	Somewhat Important	Not Important	X	SD	N
Health problems or personal problems	22%		78%	2.56	0.88	9
The course was too hard for me	11%		89%	2.78	0.67	9
The course was too much work		11%	89%	2.89	0.33	9
I did not like the instructor	22%	22%	56%	2.33	0.87	9
The subject matter was boring or irrelevant	22%		78%	2.56	0.88	9
I had too many other courses and needed to drop one (or more)	22%		78%	2.56	0.88	9
I was doing poorly	11%	11%	78%	2.67	0.71	9
I did not like the "virtual classroom" approach	22%	11%	67%	2.44	0.88	9
I had too many outside demands (other classes, full-time work)	33%		67%	2.33	1.00	9

If I had the opportunity, I would register for another class which used the "Virtual Classroom" approach:

1	2	3	4	5
11%	22%	22%	0%	44%
Strongly Agree	Agree	Don't Know	Disagree	Strongly Disagree

MOST IMPORTANT REASON
(1) 38% CONFLICTING DEMANDS
(2) 12% SIMILAR CLASS
(3) 12% FAMILY PROBLEMS
(4) 25% TOO HARD
(5) 12% DISLIKE INSTRUCTOR

VARIATIONS AMONG COURSES

"Course" is not a unidimensional variable. It includes differences in type and level of subject matter; differences in type of use of the system (totally online vs. partially online courses); cognitive level of the students (mostly freshmen vs. upper classmen or graduate students); differences in teaching style and procedures; and is also confounded with differences in access to the system, since some courses were offered through Upsala, where equipment access was relatively poor. It is not possible to separate out which aspect of "course" may account for significant differences in outcomes among courses. But this much is clear: on almost every measure of process and outcome, there are substantial and statistically significant differences among courses.

Variations in Student Ability, by Course

In addition to differences among courses in the initial motivations of students, there were also differences in ability levels. We collected data on overall Grade Point Average and on SAT scores for those students included in the quasi-experimental research design. These data are shown in Tables 4-3 through 4-5. Note that the Introductory Sociology students in the online section were fairly weak students. Their average GPA was only 2.0 (the minimum average required for graduation), and both their verbal and math SAT scores were fairly low. In addition, there was a difference among the Upsala statistics sections. Those students in the fall VC section were relatively good students with better Grade Point Averages. The Spring VC section students in the Upsala Statistics course, by contrast, were not particularly strong, and in fact had a Math SAT average just under 400.

Table 4-3

OVERALL GRADE POINT AVERAGES OF STUDENTS, BY COURSE QUASI-EXPERIMENTAL DESIGN

COURSE	FALL ONLINE	FTF	SPRING ONLINE
CIS 213	2.9	3.1	2.7
MATH 305	2.6	2.8	2.5
MANAGEMENT 471	3.1	2.5	2.8
INTRODUCTORY SOCIOLOGY (150)	2.0	2.5	
STATISTICS (CC140Y)	2.7	2.2	2.3

Table 4-4

MEAN SAT VERBAL SCORES, BY COURSE QUASI-EXPERIMENTAL DESIGN

COURSE	FALL ONLINE	FTF	SPRING ONLINE
CIS 213	333	400	444
MATH 305	375	455	364
MANAGEMENT 471	454	430	435
INTRODUCTORY SOC (150)	365	361	
STATISTICS (CC140Y)	A 427	A 332	371

SECTIONS WITH THE SAME LETTER SIGNIFICANTLY DIFFERENT, P<.05, DUNCAN MULTIPLE RANGE TEST

Table 4-5

MEAN SAT MATH SCORES, BY COURSE QUASI-EXPERIMENTAL DESIGN

COURSE	FALL ONLINE	FTF	SPRING ONLINE
CIS 213	640	580	571
MATH 305	590	480	458
MANAGEMENT 471	580	542	573
INTRO SOC (150)	409	374	-
STATS (CC140Y)	A 492	A 346	399

SECTIONS WITH THE SAME LETTER SIGNIFICANTLY DIFFERENT, DUNCAN MULTIPLE RANGE TEST

Access Problems and Activity Levels

The less than ideal access conditions described in Chapter 3 were reflected in post-course ratings of access problems. On a one-to-five scale, where "1" is "Serious Problem," and "5" is "Not a problem," those who responded with a 1 or 2 rating can be considered to have experienced difficulties. Overall, 22% said that access to a terminal or micro was a problem; 19% had problems with busy ports to EIES; and 33% complained of slow system response. As would be expected, these problems were much more prevalent at Upsala.

Differences in access problems, as well as in the mode of employment of the system, are reflected in Table 4-6, which shows monitor statistics measuring mean activity levels of students in the different courses. Activity levels varied tremendously among courses, with the highest activity levels occuring for the fall Computer Science course, and some very low levels of use for several of the Upsala courses where the system was used as an adjunct to face-to-face instruction. Consistently, both frequency of participation and total time spent online are much lower for the Upsala courses.

Two points should be kept in mind in examining these data. One is that the Connected Education students were specifically coached on how to upload and download from their micros, in order to decrease connect time, and many of the NJIT students also used this technique. Secondly, the Upsala statistics course was only a "half-course" lasting seven weeks, including the orientation meeting and the final exam. Even adjusting the data for the statistics course for the length of time, the average participation was very low, especially for the Spring online course. On the other hand, it is apparent that in some of the courses, such as the two online sections of Computer Science, the Spring Math 305 course at NJIT, and the Spring Management Lab at NJIT, the average student was checking in almost daily, and sent many private messages in addition to participating in the class conference.

Table 4.7 shows that the amount of participation in class conferences differed among the courses from a low of less than 50 comments in the main class conference for the mixed mode courses at Upsala to almost 1000 comments in the spring management lab conference. The pattern of balance between instructor contributions and student contributions also differs markedly. The most technical of the courses-- Computer Science and the two Math/Statistics courses-- tended to be "teacher-dominated" in terms of the proportion of contributions, whereas the courses in "softer" subjects tended to have the majority of comments contributed by students.

Table 4-6
DIFFERENCES IN MEAN [(PER STUDENT)] ACTIVITY LEVELS, BY COURSE

COURSE	TOTAL HOURS	TOTAL TIMES ONLINE	TOTAL MESSAGES SENT
CIS FALL	74.8	143.0	43.0
CIS SPRING	30.2	97.2	21.1
MATH 305 FALL	25.2	58.3	20.9
MATH 305 SPRING	44.9	80.3	14.7
MANAGEMENT FALL	17.7	39.4	9.1
MANAGEMENT SPRING	43.2	90.1	22.7
SOCIOLOGY FALL	18.2	37.0	23.2
STATISTICS FALL	7.9	25.2	8.2
STATISTICS SPRING	5.5	16.3	4.5
CONNECTED EDUCATION	13.0	41.7	8.1
ORG. COMMUNICATION	14.0	30.7	9.0
WRITING SEMINAR	8.3	14.4	2.5
ANTHROPOLOGY	4.3	7.1	1.2
FRENCH	8.0	20.7	4.2
F	2.3	3.9	2.5
P	.01	.001	.01

Table 4-7
PARTICIPATION PATTERNS IN CLASS CONFERENCES

COURSE	N	STUDENT COMMENTS	INSTRUCTOR COMMENTS	TOTAL COMMENTS	% COMMENTS INSTRUCTOR	% LINES INSTRUCTOR
CIS FALL	17	148	242	390	62%	71%
CIS SPRING	21	93	173	266	65%	73%
MATH 305 FALL	13	55	119	174	68%	65%
MATH 305 SPRING	27	366	111	477	23%	49%
MANAGEMENT FALL	28	367	56	423	13%	11%
MANAGEMENT SPRING	32	826	173	999	17%	17%
SOCIOLOGY FALL	17	265	115	380	30%	64%
STATISTICS FALL	14	70	55	125	44%	81%
STATISTICS SPRING	12	45	33	78	42%	81%
CONNECT-ED-1	13	330	62	392	14%	12%
CONNECT-ED-2	13	310	102	412	25%	28%
ANTHROPOLOGY	12	40	19	59	32%	18%
WRITING SEMINAR	18	33	6	39	15%	21%
ORG COMMUNICATION	12	58	35	93	38%	32%
FRENCH	8	50	11	61	18%	23%

KEYS:

N - Total number of students enrolled
STUDENT COMMENTS - Total number of comments entered by students
INSTRUCTOR COMMENTS - Number of comments entered by the instructor
TOTAL COMMENTS - Total number of comments
% COMMENTS INSTRUCTOR - Percentage of comments entered by instructor
% LINES INSTRUCTOR - Percentage of lines entered by instructor

Outcome Differences Among Courses

We have seen that student characteristics and activity levels varied among courses. In looking at the results, there were statistically significant differences among courses for almost every dependent variable, as determined by a oneway analysis of variance. A few of these differences will be presented and reviewed here.

Table 4-8 shows differences in courses on some of the indices of process and outcome. On the collaboration index, high scores correspond to higher levels of perception of collaborative or "group" learning. The highest levels of collaborative learning occurred in the Management course; it was also high for Organizational Communication, Business French, the online writing seminar, and Math 305. The level of reported collaborative learning appears to differ much more among courses than among sections of the same course offered in different modes.

For the Instructor Rating and Course Rating indices, high scores correspond to the least favorable ratings. Once again, differences among courses appear to be much larger than differences among sections of the same course offered via different modes of delivery. The only course for which there is a significant difference among sections is the Introductory Sociology course, where the students rated the instructor and outcomes as better in the face-to-face mode. In the computer science course, by contrast, the instructor and course ratings are higher in the Virtual Classroom mode. There is also a tendency for some of the best ratings to occur for the second repetition of an online course by an instructor.

In the following table (4-9), results are shown by course for the items which deal with overall comparisons between modes of delivery, including the index "VC OVERALL" which combines four items. High values of this index are the most favorable. The best overall ratings are for the second offerings of the Computer Science and Math 305 courses, and the Ontario Institute course, which was offered by an instructor experienced in this mode of teaching. The ratings for the Upsala freshman-level totally online courses tend to be among the lowest. By contrast with the students in the three upper-level NJIT courses, these students tended to feel that online courses are more boring, to disagree that they were more involved, and to agree that they would not choose another online course. However, these ratings are not characteristic of the upper-level, partially online courses at Upsala.

It will be noted that differences among courses are associated with differences between the two colleges. Much of this has to do with the poorer access conditions present at Upsala. As with course as a variable, "school" was significantly related to differences for most outcome variables. Table 4-10 shows some of these results. The Upsala students perceived the system as less "friendly" and less "convenient." They were less likely to feel that they communicated more with other students or the professor, or that they learned more.

Table 4-8
SUBJECTIVELY RATED OUTCOMES, BY COURSE MEANS AND ANALYSIS OF VARIANCE

COURSE	INSTRUCTOR RATING INDEX	COURSE RATING INDEX	COLLABORATION INDEX
CIS FALL FTF	28.5	17.8	18.9
CIS FALL ONLINE	25.4	14.3	20.0
CIS SPRING ONLINE	20.5	14.8	18.9
MATH 305 FALL FTF	15.7	13.6	23.1
MATH 305 FALL ONLINE	14.8	12.5	22.1
MATH 305 SPRING ONLINE	19.2	14.5	21.7
MANAGEMENT SPRING FTF	21.4	15.0	25.3
MANAGEMENT FALL ONLINE	23.1	16.7	26.1
MANAGEMENT SPRING ONLINE	18.0	13.9	27.2
SOCIOLOGY FALL FTF	A 19.3	A 13.7	A 23.9
SOCIOLOGY FALL ONLINE	A 25.5	A 17.6	A 17.2
STATISTICS FALL FTF	26.9	19.0	22.9
STATISTICS FALL ONLINE	25.8	18.7	21.0
STATISTICS SPRING ONLINE	25.9	17.8	20.2
CONNECT-ED	25.0	17.0	19.1
ONTARIO INSTITUTE	19.0	13.6	22.6
ORG. COMMUNICATION	22.2	15.2	24.3
WRITING SEMINAR	18.4	13.7	23.4
ANTHROPOLOGY	18.6	14.1	20.9
BUSINESS FRENCH	20.8	13.3	24.6
F	7.7	2.6	5.3
p	.001	.001	.001

A- The two sections are significantly different
Duncan Multiple Range Test (p <.05)

KEY: Instructor Rating Index Range = 11 (best) to 55 (worst)
Course Rating Index Range = 7 (best) to 35 (worst)
Collaboration Index Range= 6 (least) to 34 (most

Table 4-9
DIFFERENCES IN PERCEPTIONS OF THE VIRTUAL CLASSROOM, BY COURSE: MEANS AND ANOVA

COURSE	ONLINE MORE BORING	MORE INVOLVED	WOULD NOT CHOOSE	BETTER LEARNING	VC OVERALL
CIS FALL	4.8	2.8	5.1	3.4	19.4
CIS SPRING	5.7	3.1	5.7	2.7	20.5
MATH 305 FALL	4.6	3.6	4.3	3.6	17.0
MATH 305 SPRING	4.8	3.5	5.3	3.3	19.7
MANAGEMENT FALL	5.0	3.0	5.2	3.4	18.8
MANAGEMENT SPRING	6.2	2.0	6.1	2.0	23.0
SOCIOLOGY FALL	3.9	4.4	3.8	4.6	14.5
STATISTICS FALL	3.9	4.4	3.6	5.0	13.9
STATISTICS SPRING	3.9	5.0	3.6	5.0	14.3
CONNECT-ED	5.5	3.3	6.7	4.5	18.5
ONTARIO INSTITUTE	6.3	2.9	6.3	2.8	21.5
ORG. COM.	4.2	3.6	4.1	4.1	15.4
WRITING SEMINAR	4.1	3.0	4.1	4.1	16.6
ANTHROPOLOGY	3.9	4.0	3.3	4.9	13.6
FRENCH	3.5	3.2	4.5	4.2	16.5
F	3.0	2.7	3.7	3.7	3.4
p	.001	.001	.001	.001	.001

Key: 1=Strongly agree, 7=Strongly disagree
"VC" Overall index may range from 4(worst) to 28(best)

Table 4-10

SELECTED SIGNIFICANT DIFFERENCES IN VIRTUAL CLASSROOM RATINGS, BY SCHOOL

QUESTION	UPSALA	NJIT	F	p
SLOW RESPONSE	3.4	3.7	7.32	.008
EASY TO LEARN	4.4	5.6	19.77	.001
EIES FRIENDLY	4.0	5.4	25.03	.001
EIES INCREASED QUALITY (R)	4.2	3.1	12.76	.001
CONVENIENT (R)	4.4	2.6	36.75	.001
COMMUNICATED MORE (R)	4.4	3.4	9.92	.002
ACCESS PROFESSOR (R)	4.0	3.0	9.91	.002
MORE BORING	4.1	5.3	14.66	.001
MORE INVOLVED (R)	4.1	3.0	16.87	.001
NOT CHOOSE ANOTHER	3.8	5.4	21.46	.001
BETTER LEARNING (R)	4.5	3.0	22.57	.001
LEARNED MORE (R)	4.4	3.2	16.34	.001

Note: Items are 1 to 7 scales. Those with an (R) indicate that scoring is reversed, so that low scores are "better."

Process and Outcome: Relationships at the Course Level

A number of dimensions on which courses varied significantly have been displayed and discussed. One way to pull this information together is to look at the extent to which rank ordering of courses on outcome measures is related to rank ordering on other variables. Some results of this analysis are shown in Table 4-11.

The first thing to notice is that all the Upsala courses are at the bottom on the "VC OVERALL" index. In other words, outcomes were better for every single NJIT course than for every single Upsala course.

A second noticeable tendency is that the "top three" courses in overall ratings were the second semester offerings of courses at NJIT; there is a consistent improvement with experience by the instructor for these courses.

Looked at on the course level, with only 13 cases, student overall ratings of the Virtual Classroom are strongly related to amount of activity in their class conferences. The rank orders for average number of times each student signed online and for the total comments in the class conference are shown as examples. The courses with the best outcomes were those in which the students signed on frequently, and in which there was a lot of activity. (Which is cause, and which effect, is impossible to untangle with these data).

On the other hand, we totally failed to be able to explain variations in course outcomes in terms of any codable aspect of instructor behavior. An example is shown in Table 4-11 for a simple measure, the total proportion of comments by students. (A previous table showed the obverse, the proportion by the instructor). We had thought that classes in which the professor stimulated the students to do most of the writing would have better results than those in which many of the entries were by the instructor. However, even on this basic measure of process, there is no significant relationship. Several of the more "teacher-dominated" sections of courses, in Math and Computer Science, were among the highest ranking on overall student ratings of their VC learning experience.

Table 4-11

RANK ORDERS OF COURSES: PROCESS VS. OUTCOME

	VC Overall Index	Mean Times Online	Total Conference Comments	% By Students
NJIT Management Spr (M)	1	3	1	3
NJIT CIS Spring	2	2	6	12
NJIT Math 305 Spring	3	4	2	5
NJIT CIS Fall	4	1	4	11
NJIT Management Fall (M)	5	6	3	1
NJIT Math 305 Fall	6	5	7	13
Upsala Writing (M)	7	12	13	2
Upsala French (M)	8	10	11	4
Upsala Org. Comm.(M)	9	8	9	8
Upsala Sociology	10	7	5	6
Upsala Statistics Spring	11	11	10	9
Upsala Statistics Fall	12	9	8	10
Upsala Anthropology (M)	13	13	12	7

Key: M denotes a mixed mode course
Spearman's Rho's:
VC overall with Times online: 0.82, p=0.001
VC overall with Total comments: 0.70, p=0.004
VC overall with % by students: 0.11, p=0.36

SUMMARY

Average subjective ratings of the Virtual Classroom by students are shown in Table 4-12, rank ordered from those items on which students were most enthusiastic or positive to those on which they were least positive. Among the attributes of the Virtual Classroom experience which are rated highly are increased access to the professor, increased interest and involvement, and being able to see other students' assignments. On the downside, students were more likely to procrastinate and stop actively participating online when they became "busy with other things," and they felt that VC requires them to work harder.

There was a great deal of variation around these averages. In some courses, students were much more active and involved than in others. In addition, on almost every criterion, there was a difference between Upsala and NJIT, with NJIT students viewing their experiences more favorably. This may be due both to the poorer equipment situation at Upsala; and/or to the fact that the Upsala courses that were totally online were freshman-level, whereas all the NJIT courses were at a sophomore or higher level.

TABLE 4-12

Summary of Student Perceptions of the Virtual Classroom

Characteristics	Better Neutral Worse <------- ------->> 2.0------------3.0--------------4.0----------5.0
More From Traditional(R)	2.4
Choose Another (R)	3.1
(Not) More Boring (R)	3.2
Others' Assignments Useful	3.2
Better Access to Professor	3.3
More Involved	3.3
Comments Useful	3.3
Increased Quality	3.4
Increased Motivation	3.4
(Not) More Inhibited (R)	3.5
Better Learning	3.6
Learned More	3.7
Increased Efficiency	3.7
More Convenient	3.7
Communicated More With Students	3.7
Stop Participating (R)	4.2
Less Work	4.9

Key: Ratings could vary from 1.0 to 7.0. In computing means for this display, scoring of negative items was reversed (R)

CHAPTER 5

EFFECTS OF MODE OF DELIVERY

The purpose of this chapter is to examine differences in the objectively and subjectively measured outcomes of courses, as they were affected by mode of delivery. We were concerned with three modes of delivery: completely online, mixed, and face-to-face. Since we have seen that outcomes appear to be strongly related to the course, to the school (including its computing environment), and perhaps to whether an online course was a first-time or a repeat experience for an instructor, it was necessary to use the quasi-experimental designs built into this study in order to examine the relationship between mode and outcome. Thus, though we will include some oneway analyses of variance which simply compare the overall means of outcome measures by mode of delivery, the primary method of analysis will be a two-way analysis of variance (using the SAS General Linear Models procedure) which identifies interactions of mode with course, school, or semester (first vs. second offering).

DIFFERENCES IN SUBJECTIVELY PERCEIVED OUTCOMES, BY MODE

Of the scores of variables used in this study, very few were significantly related to mode of delivery, when all courses delivered completely online, in mixed mode, or face-to-face were pooled into three groups. Table 5-1 gives the results of most interest. It includes the dependent variables based on subjective measures which were of primary interest (the indexes), plus individual items measured for all modes which produced statistically significant differences.

There were no significant differences among modes in the overall course rating index, interest index, or synthesis index. For the instructor rating index and the collaborative index, the mixed mode of delivery was associated with significantly better ratings. However, in looking at individual items, it was interesting that the mixed mode produced significantly worse ratings in two cases. Students in mixed-mode courses reported that the course requirements were less clear, and that they were less likely to have completed all the written assignments. Apparently, although the mixed mode of delivery is exciting and provides very good conditions for collaborative learning among students, the combination of traditional and online activities can prove overwhelming and confusing for students.

As would be expected, students who used the Virtual Classroom were significantly more likely to report increased computer competence. Those who had completely online courses were most likely to have been stimulated to do additional outside reading related to the course. On the other hand, for all courses combined, the expectations concerning developing relationships with other students online were not bourne out. Students in the totally online courses were less likely to report having developed new friendships in the class, and less likely to feel that they had developed their ability to communicate clearly about the subject.

Table 5-1
COURSE OUTCOMES BY MODE OF DELIVERY
MEANS AND ANOVA

VARIABLE	ONLINE	MIXED	F-T-F	F	p
COURSE RATING INDEX	16.0	15.0	15.3	1.38	.25
INSTRUCTOR RATING INDEX	22.1 A	19.8 A	21.2	3.02	.05
COLLABORATIVE INDEX	20.6 A	24.9 AB	23.0 B	20.7	.001
INTEREST INDEX	10.4	10.3	10.0	.7	.48
SYNTHESIS INDEX	10.8	11.3	11.2	1.7	.18
INCREASED COMPUTER COMPETENCE	2.1 A	2.1 A	3.1 AB	30.95	.001
NEW FRIENDSHIPS	2.6 AB	2.0 A	2.2 B	9.44	.001
COMPLETED WRITTEN ASSIGNMENTS	1.9 A	2.2 AB	1.9 B	4.11	.02
STIMULATED ADDITIONAL READING	2.7 AB	3.1 A	3.1 B	4.58	.01
DEVELOPED ABILITY TO COMMUNICATE	2.5 AB	2.1 A	2.3 B	11.24	.001
COURSE REQUIREMENTS CLEAR	2.1 A	2.4 AB	2.0 B	4.54	.01

ENTRIES IN THE SAME ROW WITH THE SAME LETTER ARE SIGNIFICANTLY DIFFERENT, DUNCAN MULTIPLE RANGE TEST

DIFFERENCES IN OBJECTIVELY GRADED PERFORMANCE

For those courses with matched online and traditional sections, one "objective" measure of the influence of mode of delivery on course outcomes was the grades obtained. As can be seen in Table 5-2, there was only one significant difference in grades, when course was controlled. However, the picture was very mixed and muddied. The number of subjects in each section was small, and thus differences would have to be large to be statistically significant. Secondly, despite the original plan to give exactly the same midterm, final, and assignments in matched sections, and to grade them the same way, the instructors found that they could not do this.

In the management course, the instructor reported that the assignments completed by students in the section which had the Management Lab online, were far superior. However, he felt that he should not penalize the students who did not have this facility, so he did not grade them on the same standard.

In the Sociology course, the initial midterm grades on the same exam were much worse in the online section. The instructor felt that this might have been due to the fact that they had been doing assignments that were different than those in the face-to-face section, and which were not as closely related to the questions that were included in the examination. Therefore, he gave them a chance to attend two face-to-face review sessions which did concentrate on the types of questions that were on the exam, and to retake the exam. Five students availed themselves of this opportunity. The final exam in Introductory Sociology was the same and administered under the same conditions for both sections, however, and there was no difference in scores. The students in the online section did turn in more and better written assignments, so their overall course grade was higher, though not significantly so.

In the required freshman level course in statistics at Upsala, all grades in all sections tended to be low. It became a matter of which failure rates were highest! Performance was equally poor, on the average, in both sections.

In the Computer Science course at NJIT, the instructor gave additional activities and assignments online, because he found that the students could complete the core material contained in the lectures much faster online. For this course, the difference on midterm exam scores approaches significance (p= .12), with the online students doing better. There was no difference in the final exam scores, but when the quality of assignments was factored in, the instructor judged the online students as having done significantly better work, on the average. The online students averaged a solid "B" (3.11 on a 4 point scale where A= 4.00 B= 3.00, etc.), whereas the face-to-face students averaged a C- (1.93).

Thus, the overall conclusion is that online students learned the required material for a course as well as or better than students in face-to-face classes. In a course where computer usage is intrinsic, the performance may tend to be significantly better. At the Freshman level, in survey courses in which many students have difficulties passing, even though there is no significant difference in objective measures of performance, the instructors felt that totally online delivery would not be beneficial. The better students did very well in these freshmen level courses online, but the weaker students tended to drop out or do even more poorly, according the the perceptions of the instructors in their course reports.

Table 5-2
DIFFERENCES IN GRADES BY MODE AND COURSE
QUASI-EXPERIMENTAL DESIGN

MEAN MIDTERM EXAM GRADE

COURSE	ONLINE	FTF	BOTH
CIS 213	90.7	80.1	85.4
INTRO SOCIOLOGY	75.2	75.9	75.5
STATISTICS	68.8	69.5	69.6
ALL	78.5	75.2	

F= 2.82 p=.02
Mode F= .91 p= .34
Course F= 6.43 p= .003
Mode by Course F= .98 p= .38

NO SIGNIFICANT DIFFERENCES WITHIN COURSES

MEAN GRADE ON FINAL EXAM

COURSE	ONLINE	FTF	BOTH
CIS 213	79.3	78.8	79.1
MATH 305	79.0	81.6	80.3
INTRO SOCIOLOGY	68.4	68.7	68.5
STATISTICS	53.6	56.4	55.0
ALL	70.1	71.4	

F= 5.27 p=.001
Mode F= .13 p= .72
Course F= 11.28 p= .001
Mode by Course F= .06 p= .98

NO SIGNIFICANT DIFFERENCES WITHIN COURSES

FINAL COURSE AVERAGE

COURSE	ONLINE	FTF	BOTH	p
CIS 213	3.11	1.93	2.52	.02
MATH 305	3.25	3.16	3.20	.85
SOCIOLOGY	1.62	1.47	1.54	.74
STATISTICS	2.23	2.35	2.29	.78
MANAGEMENT	2.68	2.85	2.76	.68
ALL	2.58	2.35		

ANOVA F= 4.27 p= .001
Mode F= 1.23 p= .27
Course F= 7.58 p= .001
Mode by Course F= 1.3 p= .27

Measuring Changes in Writing Scores

One of the online courses was a freshman writing seminar at Upsala. A pre-test of essay writing skill was administered to all freshmen before they took this course. During the Spring semester, after they completed the course, a similar essay examination was given to the students. Both were graded on a holistic basis, as follows. The faculty is first "normed" by having all graders evaluate some sample essays which are photocopied, and then discussing differences in the scores assigned. Two faculty members assign a score from 1 to 10 for the essay. These two scores are averaged if they are reasonably consistent. If the two scores are more than two points apart, a third faculty member scores the exam, and then the two most similar scores are used.

If the students in the section which did assignments online improved more than other students as a result, this ought to be reflected in a more positive change in their writing scores than would be characteristic of students in the totally offline sections. However, as can be seen in Table 5-3, this was not the case. In fact, their scores went down a fraction of a point. There were no significant differences between this section and the traditional sections.

However, this measure also shows no change in holistically scored essays for the entire set of courses. In other words, if all freshmen in all the writing sections improved their writing in any way in a one semester course, this measure did not detect it.

What happened here? Certainly we have no evidence to conclude, on the basis of these scores, that use of the Virtual Classroom on EIES improved writing. Discussions with the Director of the writing program at Upsala, Jim Stam, provide some possible explanations. The holistic grading procedure used at Upsala is neither very sensitive to specific types of changes in writing, nor very reliable. The graders are all faculty involved in the program and any other faculty or administrators who can be recruited to volunteer to grade some 300 essays during a few hours. Prof. Stam observed that the faculty was "hastily normed" and that the scoring does not appear to be very reliable. The procedure does show significant change, on the average, for the Basic Skills remedial course, which is required of all students who score less than 5 on the first exam. (These scores do not appear in Table 5-3, since the target course chosen was the writing seminar for those deemed not to have serious deficiencies). Prof. Stam pointed out that in 14 weeks, each student is usually concentrating on improving one or two aspects of their writing. While they are concentrating on this aspect, others may actually get worse.

There was also an interesting methodological problem. All students used paper and pens for their pre-test. The traditional sections used paper and pens for their writing during the course, and the same for the post-test. The students in the experimental section used a personal computer, and the text processing built into EIES, for all their writing assignments. Then they used paper and pens for the post-test writing sample. Perhaps the skills learned for writing and revising using a computer and for "talking through your fingers" do not carry over to writing in a non- computer-supported mode?

If we were to conduct an experiment on changes in writing in the future, we would change the procedures used here. First of all, writing ought to be measured on both the pre- and post-test on a number of separate dimensions (e.g., grammar, organization, clarity, originality, expressiveness, completeness and length of the essay).

There should be three conditions: no computer support, micros with word processors for students to individually use a computer for writing assignments; and the addition of Virtual Classroom for exchanging drafts and discussing and commenting on drafts, for some sections. Sections which use the computer for writing ought to use it for the post-test, since that is how the students will be used to writing.

Instuctors in the non-writing courses were asked if they had noticed any changes in their students' writing over the course of the semester as they used the system. Most agree that there was definitely a tendency for students to write a lot more as the semester progressed.

Paul Levinson, of Connected Education, offers the following observations:

> Connect Ed has had one dramatic case of a woman with dyslexia or similiar problem. When she first signed up for our courses, she was concerned lest her disability prevent her from participating. Her first comments were intelligent, but short and not very flowing.
>
> Less than a year later she was uploading 300 line term papers that read beautifully.
>
> Other more common consequences of on-line writing seem to be a general increase in the flow and smoothness of the writing over a few month period of time.

Because of the insensitivity and unreliability of the holistic scoring methods used, we are not ready to conclude that Virtual Classroom makes "no difference" in students' writing. A much more carefully controlled study would be necessary in order to determine what changes in student writing, if any, are more likely or less likely to emerge when writing assignments are shared with others online, as compared to other modes for teaching writing.

Table 5-3

TEST OF SIGNIFICANT IMPACT ON WRITING SCORES

	ONLINE	OTHERS	F	P
TEST 1 MEAN	6.60	6.87	.29	.59
TEST 1 SD	1.45	.90		
N	15	302		
TEST 2 MEAN	6.29	6.91	1.72	.19
TEST 2 SD	1.33	1.76		
N	14	271		
DIFFERENCE MEAN	-.31	.04	.51	.48
DIFFERENCE SD	1.25	1.75		
N	13	267		

NOTE: Writing Scores on the two exams may vary from a low of one to a high of ten. Anything below five is considered to be below minimum college level.

OUTCOMES BY MODE AND COURSE

When a two-way analysis of variance was used for all dependent variables, employing the matched Fall courses in the quasi-experimental factorial design, the results of the previous one-way analyses were verified. Almost all differences in outcomes were associated with differences among courses, rather than with differences among modes. There was some interaction between course and mode, but given the small number of cases, interaction was generally not statistically significant. With such a small number of students in each of the course by mode conditions, differences had to be extremely large and consistent to reach statistical significance; therefore, even differences significant at only the .10 level were worth looking at.

The five tables which follow present the results for individual variables which produced some significant differences, and for the indices measuring the dependent variables of primary concern. In terms of students reporting that they completed their required readings (table 5-4), the primary differences were among courses: readings were least likely to be completed in the Management course. In this course and in the Sociology course, there was some tendency for the readings to be more regularly completed in the face-to-face mode, but the difference was not significant.

For increased interest in the subject matter, once again, there was no overall difference by mode, but there was both a difference by course and some interaction between course and mode (table 5-5). For instance, there was a tendency in both the lower level and the upper level statistics courses and in the Computer Science course for interest to have increased more in the online sections, but the reverse is true in Introductory Sociology.

Synthesis scores were also apparently affected by an interaction between course and mode (table 5-6). They were higher online in two courses, and higher in the traditional sections for three of the courses.

Looking at the overall Instructor Rating and Course Rating indices (tables 5-7 and 5-8), the earlier findings, that differences among courses account for more of the variance than differences among modes of delivery, are confirmed. For both of these indices, ratings were better for the online sections of Computer Science and the upper level statistics course (Math 305) and worse for the online section of Introductory Sociology; but once again, few of the individual differences within course were significant.

In sum, it was differences among courses that accounted for most of the differences in outcome measures. To the extent that there was some interaction between mode of delivery and course, the pattern was not consistent. Within courses, none of the differences in outcome by mode was large enough to be statistically significant, and the direction of the differences that occur was mixed. There was a fairly consistent tendency for the ratings for Computer Science to be higher in the online sections and for the ratings for Sociology to be higher for the face-to-face section.

Table 5-4

Completed Required Readings, by Mode and Course

Means and Anova

	MODE		
Course	Online	FTF	Both
CIS 213	2.1	2.1	2.1
MATH 305	2.2	2.6	2.4
STATISTICS	2.2	2.4	2.3
SOCIOLOGY	2.5 A	1.8 A	2.1
MANAGEMENT	3.2 A	2.6 A	2.9
All Courses	2.4	2.3	

* Conditions with letter A are significantly different at 0.05 level

Anova:	F=3.62	p=0.001
Mode:	F=0.77	p=0.382
Course:	F=5.41	p=0.001
Mode x Course:	F=2.19	p=0.072

Key: 1= Strongly Agree
5= Strongly Disagree

Table 5-5

Interest Index by Mode and Course

Means and Anova

	MODE		
Course	Online	FTF	Both
CIS 213	11.6	10.4	11.0
MATH 305	12.0 A	9.8 A	11.0
STATISTICS	8.7	7.9	8.3
SOCIOLOGY	8.7 A	10.9 A	9.8
MANAGEMENT	9.3	10.3	9.8
All Courses	10.0	9.9	

* Conditions with letter A are significantly different at 0.05 level

Anova:	F=5.74	p=0.001
Mode:	F=0.31	p=0.579
Course:	F=8.09	p=0.001
Mode x Course:	F=5.74	p=0.001

Range= 3 (low) to 15 (high)

Table 5-6

Synthesis Index by Mode and Course

Means and Anova

	MODE		
Course	Online	FTF	Both
CIS 213	11.0	10.6	10.8
MATH 305	12.3	11.6	12.0
STATISTICS	9.8	10.3	10.0
SOCIOLOGY	10.0 A	11.9 A	10.9
MANAGEMENT	10.7	11.2	10.9
All Courses	10.8	11.1	

* Conditions with letter A are significantly different at 0.05 level

Anova:	F=2.29	p=0.020
Mode:	F=1.01	p=0.315
Course:	F=3.18	p=0.015
Mode x Course:	F=1.71	p=0.150

Range= 3 (low) to 15 (high)

Table 5-7

Instructor Rating Index by Mode and Course

Means and Anova

	MODE		
Course	Online	FTF	Both
CIS 213	25.4	28.5	27.0
MATH 305	14.8	15.7	15.2
STATISTICS	25.8	26.9	26.3
SOCIOLOGY	25.5 A	19.3 A	22.4
MANAGEMENT	23.0 A	20.2 A	21.6
All Courses	22.9	22.1	

* Conditions with letter A are significantly different at 0.05 level

Anova:	F=12.34	p=0.001
Mode:	F= 0.80	p=0.374
Course:	F=20.94	p=0.001
Mode x Course:	F= 3.63	p=0.008

Range= 11 (best) to 55 (worst)

Table 5-8

Course Rating Index by Mode and Course

Means and Anova

	MODE		
Course	Online	FTF	Both
CIS 213	14.3	17.1	15.7
MATH 305	12.5	13.6	13.1
STATISTICS	19.2	18.6	18.9
SOCIOLOGY	17.6 A	13.7 A	15.7
MANAGEMENT	16.7 A	14.6 A	15.6
All Courses	16.1	15.5	

* Conditions with letter A are significantly different at 0.05 level

Anova:	F=4.42	p=0.001
Mode:	F=0.62	p=0.431
Course:	F=6.22	p=0.001
Mode x Course:	F=2.61	p=0.038

Range= 7 (best) to 35 (worst)

INTERACTIONS OF MODE AND SCHOOL

"School," as we have previously noted, was related to differences in Virtual Classroom outcomes not only because of differences in equipment access conditions, but also because it was confounded with differences in the level of the courses which were offered. At NJIT, the online courses were for undergraduate students in the Sophomore to Senior years; at Upsala, the totally online courses were Freshman-level, while the mixed-mode courses were for upper level undergraduate courses; and for Connected Education and OISE, the courses were at the post-graduate level, and all students had their own microcomputers. Thus, it is not surprising that there was an interaction between "school" and mode for most of the outcome variables. Included here are only the most important of the results of these analyses; most outcome variables showed results that varied simultaneously by school as well as by mode of delivery.

In the first table (5-9) in this series of selected significant interactions by mode and school, we see that the students' perceptions of problems with sufficient access to a terminal or microcomputer are in some ways different than might have been imagined. For the remote education students in Connected Education and OISE, as would be expected, access was not a problem. However, the surprising things were that student perceptions of access problems were higher at NJIT than we assumed they would be, and at Upsala, for unclear reasons, the access problems were considered more serious in the mixed-mode courses than in the totally online courses. This may be because those in the totally online courses were prepared to have to go to the microlab to use computers, while those in the mixed mode courses had not chosen that mode and resented the trip more.

The next three tables show the results for some specific course outcomes. In terms of developing an increased ability to communicate one's ideas clearly, the best outcomes were for the mixed mode courses at Upsala (Table 5-10). For improving one's ability to critically analyze written material, the students in the totally online courses at NJIT reported significantly higher levels of improvement, while those in the mixed modes courses at Upsala were most likely to perceive improvements in this area (Table 5-11). For increasing confidence in expressing one's ideas (Table 5-12), the pattern of significantly better results in Upsala mixed modes courses than in either totally online or totally face-to-face courses continued. At NJIT, the mixed modes condition also resulted in the best overall ratings on this outcome criterion.

The next set of results turned to some overall outcome indices that applied to results for all three modes. The best overall scores on the "Increased Interest" index (Table 5-13) were for the remote education students, the NJIT totally online courses, and the Upsala mixed modes courses. For degree of collaborative learning, the index scores were highest for the mixed-modes condition, at both NJIT and Upsala. Instructor rating indexes tended to be highest for totally online courses at NJIT, and for the mixed-mode courses at Upsala (Table 5-14).

The final table in this series is for outcomes measured only for those students who used Virtual Classroom, and who compared it to previous face-to-face courses. For the VC Overall rating index (Table 5-15), the best ratings occured for the mixed modes delivery at NJIT and the totally online remote education students. At both NJIT and Upsala, the mixed modes students gave higher overall ratings to the Virtual Classroom than did the totally online students, though neither difference was statistically significant.

Table 5-9

Terminal Access Problem, by Mode and School

Means and Anova

		MODE	
School	Online	Mixed	Both
NJIT	3.5	3.9	3.6
UPSALA	3.8 A	2.9 A	
CONNECT-ED	4.8		
Others	4.6		
All Schools	4.2		

* Conditions with letter A are significantly different at 0.05 level

Anova:	F=4.08	p=0.001
Mode:	F=0.74	p=0.478
School:	F=4.27	p=0.006
Mode x School:	F=8.30	p=0.004

KEY: 1= Serious Problem 5= Not a problem

Table 5-10

Developed Ability to Communicate Clearly
by Mode and School

Means and Anova

	MODE			
School	Online	Mixed	FTF	All
NJIT	2.3	2.2	2.2	2.2
UPSALA	2.9 AB	2.0 AC	2.4 BC	2.4
CONNECT-ED	2.9			
Others	2.4			
All Schools	2.6			

* Conditions with letter A,B, & C are significantly different at 0.05 level

Anova:	F=3.30	p=0.001
Mode:	F=5.94	p=0.003
School:	F=1.82	p=0.144
Mode x School:	F=2.88	p=0.036

Key: 1= Strongly Agree
5= Strongly Disagree

Table 5-11

Improved Critical Analysis Ability, by Mode and School

Means and Anova

	MODE			
School	Online	Mixed	FTF	All
NJIT	2.2 A	2.6 A	2.3	2.4
UPSALA	2.6	2.3	2.6	2.5
CONNECT-ED	3.6			
Others	2.7			
All Schools	2.8			

* Conditions with letter A are significantly different at 0.05 level

Anova:	F=3.44	p=0.001
Mode:	F=0.13	p=0.881
School:	F=4.97	p=0.002
Mode x School:	F=2.66	p=0.049

KEY: 1= Strongly Agree
5= Strongly Disagree

Table 5-12

Increased Confidence in Expressing Ideas, by Mode and School

Means and Anova

			MODE	
School	Online	Mixed	FTF	All
NJIT	2.2	2.0	2.2	2.1
UPSALA	2.7 A	2.2 A	2.5	2.4
CONNECT-ED	2.7			
Others	2.4			
All Schools	2.5			

* Conditions with letter A are significantly different at 0.05 level

Anova:	F=2.91	p=0.004
Mode:	F=5.41	p=0.005
School:	F=4.09	p=0.007
Mode x School:	F=1.67	p=0.174

KEY: 1= Strongly Agree 5= Strongly Disagree

Table 5-13

Interest Index by Mode and School

Means and Anova

	MODE			
School	Online	Mixed	FTF	All
NJIT	11.0 A	9.9 A	10.2	10.4
UPSALA	8.9 A	10.6 A	9.6	9.7
CONNECT-ED	11.2			
Others	11.4			
All Schools	10.6			

* Conditions with letter A are significantly different at 0.05 level

Anova:	F=3.59	p=0.001
Mode:	F=0.60	p=0.550
School:	F=3.54	p=0.015
Mode x School:	F=5.02	p=0.002

KEY: Index range= 3 (low) to 15 (high)

Table 5-14

Instructor Rating Index by Mode and School

Means and Anova

	MODE			
School	Online	Mixed	FTF	All
NJIT	19.4	20.4	21.0	20.3
UPSALA	25.9 A	19.0 AB	22.9 B	22.6
CONNECT-ED	27.0			
Others	19.9			
All Schools	23.0			

* Conditions with letter A & B are significantly different at 0.05 level

Anova: F=4.20 p=0.001
Mode: F=3.80 p=0.024
School: F=4.17 p=0.007
Mode x School: F=4.70 p=0.003

Key: Index range= 11 (best) to 55 (worst)

Table 5-15

VC Overall Index by Mode and School

Means and Anova

			MODE
School	Online	Mixed	Both
NJIT	19.1	20.9	20.0
UPSALA	14.2	15.6	14.9
CONNECT-ED	17.0		
Others	21.4		
All Schools	17.9		

Anova:	F= 6.62	p=0.001
Mode:	F= 2.49	p=0.117
School:	F=10.28	p=0.001
Mode x School:	F= 0.03	p=0.854

Key: Index range= 4 (lowest rating) to 28

EFFECTS OF REPEATING COURSES A SECOND TIME

Four of the courses which were totally or partially online the first semester were repeated the second semester. The assumption was that with experience, not only would the process of teaching online be easier for the instructor, but it would also result in better outcomes perceived by the students.

There was a tendency for courses to improve the second time they were offered online, but there are many exceptions to this generalization when specific courses and outcomes are examined. Taking the overall results first, outcomes for the overall student rating index for the Virtual Classroom are shown in Table 5-16. It was true that these overall ratings were better the second semester for all courses that were repeated. However, only the Management Lab showed a statistically significant improvement.

In terms of final grades assigned to students, which measured the instructor's perceptions of the students' performance, there were no significant differences (Table 5-17). Perhaps this was to be expected, since instructors may tend to grade on a curve for any class. There was also a mix in the direction of the non-significant differences in average grades that did occur: grades were higher the first semester in the Upsala statistics course and CIS 213 at NJIT, and higher the second semester for the Management course.

The management course was the only one which tended to consistently show significant improvement the second semester on one outcome measure after another. Looking at interest in the subject matter, for instance, this was the only difference between semesters which was significant (Table 5-18). The same was true for increases in the perception of Collaborative Learning (Table 5-19). Looking at the scores on the instructor rating index (Table 5-20), the second semester the instructor was rated significantly better only for CIS 213 and the Management course. For the Math 305 course, the instructor rating was actually better the first semester; however, since this instructor had exceptionally high ratings in all modes and semesters, we may be seeing a kind of "regression effect."

Table 5-16

VC Overall Rating Index by Semester and Course

Means and Anova

	SEMESTER		
Course	1	2	Both
CIS 213	19.4	20.5	20.0
MATH 305	17.0	19.7	18.3
STATISTICS	13.9	14.3	14.1
MANAGEMENT	18.8 A	23.0 A	20.9
All Courses	17.3	19.4	

* Conditions with letter A are significantly different at 0.05 level

Anova:	F=4.10	p=0.001
Course:	F=6.86	p=0.001
Semester:	F=3.31	p=0.072
Course x Semester:	F=0.70	p=0.556

Key: Index may range from 4 (lowest) to 28

Table 5-17

Final Grade by Semester and Course

Means and Anova

	SEMESTER		
Course	1	2	Both
CIS 213	3.1	2.8	2.9
MATH 305	3.2	3.3	3.2
STATISTICS	1.7	1.4	1.5
MANAGEMENT	2.7	3.1	2.9
All Courses	2.7	2.6	

Anova:	F= 5.70	p=0.001
Course:	F=11.95	p=0.001
Semester:	F= 0.03	p=0.865
Course x Semester:	F= 0.79	p=0.505

Key: A= 4.0, B= 3.0 etc.

Table 5-18

Interest Index by Semester and Course

Means and Anova

	SEMESTER		
Course	1	2	Both
CIS 213	11.6	10.9	11.2
MATH 305	12.0	10.8	11.4
STATISTICS	8.9	9.0	9.0
MANAGEMENT	9.3 A	10.5 A	9.9
All Courses	10.4	10.3	

* Conditions with letter A are significantly different at 0.05 level

Anova:	F=3.92	p=0.001
Course:	F=7.56	p=0.001
Semester:	F=0.15	p=0.704
Course x Semester:	F=2.27	p=0.084

KEY: Index scores may range from 3 (low) to 15

Table 5-19

Collaborative Index by Semester and Course

Means and Anova

	SEMESTER		
Course	1	2	Both
CIS 213	20.0	18.8	19.4
MATH 305	22.1	21.7	21.9
STATISTICS	21.0	19.4	20.2
MANAGEMENT	24.7 A	27.2 A	25.9
All Courses	22.0	21.8	

* Conditions with letter A are significantly different at 0.05 level

Anova: F= 8.10 p=0.001
Course: F=16.58 p=0.001
Semester: F= 0.05 p=0.815
Course x Semester: F= 1.76 p=0.159

Key: Collaborative Index may range from 6 (least) to 34

Table 5-20

Instructor Rating Index by Semester and Course

Means and Anova

	SEMESTER		
Course	1	2	Both
CIS 213	25.4 A	20.5 A	22.9
MATH 305	14.8 A	19.2 A	17.0
STATISTICS	25.8	25.9	25.8
MANAGEMENT	23.0 A	18.0 A	20.5
All Courses	22.2	20.9	

* Conditions with letter A are significantly different at 0.05 level

Anova:	F= 7.25	p=0.001
Course:	F=12.17	p=0.001
Semester:	F= 1.54	p=0.217
Course x Semester:	F= 5.29	p=0.002

Key: Index may range from 11 (best) to 55

SUMMARY

The previous chapter examined the results of subjective assessments of the Virtual Classroom by students who had experienced either partially or totally online courses, and who were asked to compare it with their previous experiences in face-to-face courses. The students reported VC to be different in many ways, including more convenience, better access to the professor, more involvment, but also more work.

This chapter analyzed differences among modes of delivery by using data from a quasi-experimental design. Different students were given different courses in different modes, but asked the same questions (and within course, given the same examinations). The reasoning was that if mode of delivery was a strong causal factor in influencing outcomes, this should show up as significant differences in the responses of the students receiving different "treatments."

Our samples of students within each mode and course condition were too small to provide much statistical power, but generally speaking, there were few variations in outcome associated with mode of delivery. There were constantly large and significant differences among the courses and among the schools.

In terms of grades, the only statistically significant difference was for the Computer Science course, where grades were better in the online section. This was also the course for which students in the Virtual Classroom condition spent the most time online.

An attempt to determine whether the use of VC might help improve progress in a freshman level writing course was a failure.

Holistically graded pre-and post-course essays showed no change in scores for the VC section, but also showed no change for all of the other sections. Thus we cannot determine whether the medium has no effect, or the results are due to an unreliable and insensitive scoring procedure.

When looked at by mode and school, the poorest results occured for the totally online, freshman-level courses at Upsala. The upper-level, mixed modes courses at Upsala tended to be rated relatively well; for instance, these courses had relatively high ratings for items on developing ability to communicate clearly, to improve critical analysis ability, increased confidence in expressing ideas, and increased interest in the subject matter. Thus significantly different outcomes by school and mode may be partially an artifact of differences in the level of maturity of the students enrolled in totally online courses in the two schools. The mixed-modes courses at Upsala were all upper-level; students in upper-level courses tend to be more mature and more consistently "ready" for an intensive college-level learning experience than is average student in the freshman-level courses that were totally online at Upsala.

There was a tendency for student ratings of courses to improve the second time they were offered online, but there were many exceptions to this generalization, when specific courses and outcomes were examined. For instance, although the overall ratings of the Virtual Classroom experience were higher the second time for all four courses that were repeated, only the ratings for the Management course showed a statistically significant improvement for that index.

CHAPTER 6

STUDENT ATTRIBUTES AND BEHAVIOR RELATED TO OUTCOMES

We have seen in Chapter 5 that some of the differences in outcomes of either totally online or mixed-mode courses are associated with the context provided by the course, the school and the access conditions available there, and whether a course is a first-time or a repeat offering. In this chapter, we will see that there were also many significant differences associated with student attitudes, attributes, and behavior. In the analyses summarized here, students in traditional courses were eliminated, and those in the partially and totally online sections were grouped together.

Student Characteristics as Predictors

Pre-Use Expectations become Self-Fulfilling Prophecies

Table 6-1 displays the correlations between pre-use variables and course outcomes. As would be expected, those with more positive attitudes towards computers at the outset were more likely to report more favorable course outcomes, to spend more time online, and to log on more frequently. They were also more likely to report that EIES was "easy to learn," less likely to feel at the end that they would not choose to take another online course, and rated the Virtual Classroom mode of delivery more favorably in comparison to face-to-face classes.

These same correlations tended to repeat and to be stronger when pre-use expectations about the EIES system in particular, rather than general attitudes toward computers, were used as the predictor. The implication is that participation in the Virtual Classroom mode of learning should ideally be a choice of the student, so that those with poor initial attitudes are not forced to take part. Several of the interviews in the Appendix with examples of the "most negative" of the students who participated support this interpretation of the correlations. For instance, in interview 9, the student mentioned a "lot of apprehension" at the beginning, followed by only once a week participation. In this and other cases of negative attitudes and inadvertent enrollment, there was a problem with effectively communicating with such students to "counsel them out." They seemed not to hear what they were told or to read or understand printed material directed at them. For instance, the interview 9 student complained about NJIT facilities not being open during the weekends; yet, both at training and in follow-up announcements, all students were informed of the special laboratory where Virtual Classroom students could receive assistance. This lab was open half-days on Saturdays, and unattended terminals were available all day on Saturdays.

Similarly, in interview 2, with a negative Math 305 student, the student complained that the fact that the course would be online was a total surprise to him, and that he didn't like that idea from the beginning. He claimed that it wasn't in the registration material (then admits, "Maybe it was, but I just missed it.") OFFERED VIA COMPUTER was prominently printed in all-capital letters next to the course name and section number for online courses, in the registration material, and posters and flyers were placed around the registration area. Then there was the telling little detail in interview 7 with a dropout, who carefully spelled out the instructor's name-- getting both the first and last names wrong.

It is probably not coincidental that all three of these students who started out with being "surprised" to learn about the online class at the first meeting, and with negative attitudes toward the experiment, work full time and normally were on campus only to attend class. They understandably felt overloaded and were likely to screen out anything that did not seem to "require" their attention. The interview 2 student stated, for instance,

> I don't have enough time in my day as it is... I usually go to work, then to school, then to work and then back to the house to study at 11 at night, and I didn't want to sit down and read some other stuff... To sit down and make myself do something like that... I don't have the self discipline for it.

Sphere of Control: Not a Good Predictor

Qualitative observations similar to those above led initially to the inclusion of the Sphere of Control indices as predictors. It was hypothesized that considerable self-discipline and ability to manage one's time and one's life would be necessary in order to participate regularly and sucessfully in a "sign-on anytime" Virtual Classroom experience, and the Sphere of Control measures were assumed to tap this dimension. However, the results for Sphere of Control indices were not as strong or consistent as was hypothesized. The Personal Efficacy Sphere of Control index was significantly related to the overall course outcomes index, and to the perception that EIES was easy to learn. Interpersonal Sphere of Control was significantly related to the Instructor Rating Index, and to disagreement with the statement that they would not choose to take another online course. However, neither Sphere of Control index was related to the overall rating of the Virtual Classroom and even those correlations which were significant were not very strong.

Student Maturity and Ability are Crucial

"Class standing" corresponded to the educational level of the student: freshman through graduate student. Thus, it reflected both age and previous academic experience, and could be an indirect measure of cognitive maturity. The higher the academic level of the student, the less likely they were to conclude that they would not take another online course, and the better their overall rating of their Virtual Classroom experience in comparison to previous face-to-face courses.

Since many of the students were freshmen, we were missing many Grade Point averages, so Math and Verbal Scholastic Aptitude test scores were used to explore the relationship between academic ability and achievement (whatever combination of these were measured by the SAT's), and process and outcomes in the Virtual Classroom environment. Selected results are displayed in Table 6-2. Many of these correlations were moderately strong, and very interesting.

On the whole, it was the Mathematics SAT score which predicted student success in the Virtual Classroom, much more than the Verbal SAT score. The first two correlations in Table 6-2 were included as a matter of general interest: high Sphere of Control indices were associated with high Verbal SAT's but not significantly associated with Math SAT scores. Those with high Math SAT's (but not those with high Verbal SAT's) signed on significantly more frequently, and also spent more total time online and sent more private messages. They were less likely to feel inhibited online; more likely to feel that they were more involved in the VC course than in traditional courses. The high Math SAT students also earned significantly higher final course grades online, were more likely to rate course outcomes highly, and were much more likely to give the Virtual Classroom better ratings overall than the traditional classroom.

By contrast, many of the correlations for the Verbal SAT are either weak (e.g., the weak but insigificant correlation with course grade), OR ACTUALLY REVERSED. This is very intriguing and was not expected. The high Verbal SAT students were significantly less likely to feel that VC increased access to the professor or their active involvement in the course. One can speculate about the combination of high Math SAT/Low Verbal SAT as one for which students are especially likely to "bloom" in the VC environment, but until we combine several year's samples and have a larger number of cases to work with, this will have to remain speculation.

In terms of the association between other student characteristics measured and the outcomes, the results tended to be mixed and weak, and were not included in tables here. For gender, the males did slightly better on final course grades (point biserial R= .13, p= .05). Males were also slightly more favorable, on the average, towards overall assessment of the Virtual Classroom (R= -.16, p= .02). This seems to be related to the tendency for males to like computers better and to have higher Math SAT's. The correlation between gender and post-course computer attitudes was of a similar magnitude: R= -.18 (with females coded as "2"), p= .01. However, though statistically significant, the differences related to gender were so slight as to have no practical importance. In fact, if one wanted to take the "long view," giving females a computer-intensive experience in a VC course could be seen as one way to improve their computer-related skills and attitudes.

The only correlation of outcomes with nationality was a slight

(R=.17 p= .03) tendency for non-Americans to feel that they were less able to improve their ability to pull together or synthesize the variety of materials presented in courses. In terms of native language, the only statistically significant difference was that those whose native language was not English were slightly less likely to report increased interest in the subject matter (R= .18, p= .01).

There was only one statistically significant correlation with typing ability at pre-use. Those with better typing skills had slightly better attitudes toward computers as measured post-course (R= .17, p= .02).

Table 6-1
Pearson's Correlation Coefficients Between
Student Characteristics and Selected Outcome Measures

	Computer Attitudes	EIES Expectations	Personal SOC	Inter-Personal	Class Standing
Course Outcome Index	-.12	-.19	-.16	-.08	-.10
p	.04	.01	.01	.11	.07
Instructor Rating Index	-.02	-.06	-.10	-.13	-.04
p	.40	.25	.06	.03	.27
VC Overall Index	.34	.38	.07	.07	.16
p	.001	.001	.20	.20	.02
EIES EASY TO LEARN	.43	.40	.24	.22	.14
p	.001	.001	.002	.10	.05
Not take another	.31	.33	.10	.16	.25
p	.001	.001	.11	.02	.001
Total Hours On	.15	.25	.03	-.01	09
p	.02	.001	.34	.43	.08
Total Times On	.21	.26	.11	.01	.14
p	.001	.001	.07	.44	.02

Table 6-2
Correlations between SAT Scores and VC Process and Outcome

Variable	SAT MATH	SAT VERBAL
Personal SOC	.18	.29
(N)	103	103
p	.94	.002
Interpersonal SOC	.15	.29
p	.06	.001
Total Times On	.39	.04
P	.001	.34
(Not) Inhibited	.20	.13
p	.02	.10
Access Professor	-.06	.20
p	.26	.02
More Involved	-.15	.17
p	.08	.05
Final Grade	.31	.13
p	.001	.10
Course Outcome Index	-.24	-.01
p	.01	.44
VC Overall Index	.36	.04
p	.001	.35

Access Conditions, Activity Patterns, and Outcomes

The first three columns in table 6-3 deal with aspects of "access" to the Virtual Classroom: having a micro at home, perceived problems with equipment access, and overall "convenience" of the VC mode. There were fewer and weaker correlations between having one's own microcomputer at home, amount of use of the system and reactions to it, than might be supposed. Though the correlation with overall VC rating was statistically significant, it was only .18. A second measure of access was a question asked on the post-course questionnaire about access to a terminal being a serious problem. Those who felt it was not a problem were more likely to feel that VC had increased the quality of their education, and to give more positive overall reactions to the Virtual Classroom mode.

However, access is more than merely problems getting a terminal or micro to use. It may include perceived problems with telephone lines; or perhaps, perceived problems in making time to participate. The relationship between the question rating whether or not the overall convenience of using the VC mode was greater or less than the convenience of the traditional classroom was a stronger predictor than the items specifically focussed on equipment. The "convenience" question was significantly related to the final exam grade and final course grade, as well as to subjective ratings of extent of collaborative learning, increased interest in the subject, increased ability to synthesize material in the field, attitudes toward computers at the end of the course, rating of the instructor and the course, and in particular, overall rating of VC.

All of the measures of amount of use of the Virtual Classroom tended to be related to outcome measures; the number of sessions or total number of times a student signed online was most strongly related. For instance, the correlation between number of sessions and the final exam score was .34, which was moderately strong. Level of activity was also related to the final course grade, a perception that VC increased the quality of education, more positive post-course attitudes toward computers, and the overall course rating index.

As in the pilot studies, there were strong and consistent relationships between perceptions of having communicated more with the professor and the other students online, and overall evaluations of the Virtual Classroom experience (table 6-4). Those who felt they had better access to their professor, and who read and valued the comments and assignments of other students, felt that the Virtual Classroom was a better mode of learning than traditional face-to-face classes. Those who did not actively take advantage of the communication opportunities for such a collaborative style of learning tended to prefer the face-to-face mode.

This is reinforced in the interviews with very positive and very negative students in the Appendix. There were two major determinants, thus, of outcomes of the Virtual Classroom experience. One was whether the students had the self-discipline to regularly sign online. The other was whether they used the system to interact with the ideas and suggestions of the other students as well as their instructor. These two aspects of online behavior were inter-related. For those who valued communication with other members of the class, motivation to sign online frequently was increased. Frequent, regular, and active participation helped them to do well in the online course, and contributed to their positive evaluations of the course, the instructor, the attainment of learning goals, and evaluations of this mode of educational delivery.

Table 6-3

Access and Activity Conditions, by Outcomes
Pearson Correlation Coefficients
(N of cases= 163)

	ACCESS			ACTIVITY		
	HOME	ACCTERM	CONVEN	TTOT	ONTOT	PRTOT
FINAL GRADE	.06	.10	.33	.16	.22	.17
p	.23	.12	.001	.02	.001	.02
FINAL EXAM	.06	.01	-.30	.25	.34	.28
p	.33	.48	.02	.05	.01	.03
COLLABORATIVE INDEX	.02	.02	-.15	.14	.07	.01
p	.39	.41	.03	.05	.19	.45
INTEREST INDEX	.02	.14	-.33	.12	.17	.08
p	.40	.20	.001	.06	.01	.14
SYNTHESIS INDEX	-.12	-.02	-.26	.08	.07	.03
p	.05	.39	.001	.14	.17	.35
INCREASED QUALITY	.07	.31	-.51	.16	.17	.14
p	.18	.001	.001	.02	.01	.04
COMPUTER ATTS2	.30	.37	-.53	.26	.31	.31
p	.001	.001	.001	.001	.001	.001
INSTRUCTOR RATING	-.05	-.12	.32	-.08	-.11	-.13
p	.23	.07	.001	.16	.09	.05
COURSE RATING	.06	-.14	.38	-.20	-.20	-.13
p	.23	.03	.001	.01	.01	.05
VC OVERALL	.18	.36	-.63	.22	.25	.22
p	.01	.001	.001	.001	.001	.001

KEYS: HOME= Have a terminal at home, pre-use
ACCTERM= Post question on problems with terminal access
CONVEN= Agreement with statement that VC is more convenient
TTOT= Total time online during course
ONTOT= Number of sessions online during course
PRTOT= Number of private messages sent during course

Table 6-4

Process and Assessments of the Virtual Classroom

	COMMUNICATED	ACCESS PROF	INCREASE MOTIVE	INVOLVED	COMMENTS	ASSIGNS
FINAL GRADE	-.15	-.17	-.23	-.22	-.11	-.11
p	.04	.02	.001	.001	.09	.10
FINAL EXAM	-.09	-.28	-.23	-.23	-.11	-.06
p	.04	.02	.001	.001	.09	.34
COLLABORATIVE INDEX	-.51	-.35	-.25	-.40	-.45	-.30
p	.001	.001	.001	.001	.001	.001
INTEREST INDEX	-.25	-.41	-.40	-.38	-.40	-.39
p	.001	.001	.001	.001	.001	.001
SYNTHESIS INDEX	-.32	-.44	-.43	-.37	-.34	-.33
p	.001	.001	.001	.001	.001	.001
INCREASED QUALITY	-.31	-.46	-.36	-.45	-.35	-.35
p	.001	.001	.001	.001	.001	.001
COMPUTER ATTS2	-.24	-.35	-.39	-.42	-.31	-.39
p	.001	.001	.001	.001	.001	.001
INSTRUCTOR RATING	.27	.35	.32	.28	.21	.23
p	.001	.001	.001	.001	.001	.001
COURSE RATING	.29	.40	.46	.46	.33	.32
p	.001	.001	.001	.001	.001	.001
VC OVERALL	-.41	-.60	-.48	-.64	-.44	-.48
p	.001	.001	.001	.001	.001	.001

KEYS:

COMMUNICATED= Communicated more with other students
ACCESS PROF= Provided better access to the proffesor
INCREASE MOTIVE= Fact that assignments would be read by other students increased motivation
INVOLVED= Felt more involved in taking an active part
COMMENTS= Found comments made by other students useful
ASSIGNS= Found reading assignments of other students useful

Multivariate Analyses

In various parts of this report, we have noted a series of bivariate relationships and relationships which took into account the interaction of two variables at a time. What happens when we put all our predictors together? Which ones make the biggest contribution to explaining the variance in the dependent variables, and which ones are not significant once the others are taken into account?

Because our sample size was fairly small, we did not conduct many multivariate analyses or try to push the variance accounted for too far. The problem is that as you add variables with a small sample, you run out of degrees of freedom; for example, nine variables will always explain the variance in ten cases perfectly.

We used simultaneous regression, which takes all the variables in the equations into account at the same time. This does have the methodological weakness that if two variables are strongly associated, then they will probably share variance accounted for between them, and neither one may end up statisically significant. However, without a prior theory which clearly predicted what variables would be the strongest causes, there was no basis for alternative regression procedures. In order to use "mode" and "course" as variables, a series of "dummy variables" were constructed with 0-1 values (e.g., in the dummy variable for the statistics course, it was coded as "1" and all other courses were coded "0," or "not statistics.")

In the first equation (Table 6-5), all students in all modes at NJIT and Upsala were considered, and the dependent variable was the Course Rating Index. In interpreting the signs of the beta coefficients, which are the best overall comparative measure of the level of association with the dependent variable, one must be aware of how the variables were coded, which is shown in the questionnaire items in the Appendix. The course rating scale was first introduced in Chapter 2 on methodology. Because it consisted of a series of positive statements accompanied by Likert-type scales which were displayed and scored as "1= Strongly Agree," the lower the total score, the more positive the total course rating.

The strongest predictors have nothing to do with mode of delivery. The required Freshman-level statistics course at Upsala received the lowest course ratings. Another course taken by many freshmen to fulfill a requirement, Sociology, showed up as also significantly associated with relatively poor course ratings. Only two schools were used in this analysis, with NJIT coded "1" and Upsala coded "2." The second strongest predictor of course ratings was school; despite the two specific courses with relatively low ratings, course ratings on the whole were better at Upsala. The third strongest predictor was a measure of general ability; students with high Math SAT scores rated their courses significantly better.

Mode of delivery does appear as making a significant contribution to predicting overall course ratings: the mixed mode courses have lower ratings than the other modes, when everything else was simultaneously taken into account. Since on the majority of measures, mixed mode courses fared well, we will not make a great deal of its appearance in this particular equation.

The second and third equations are only for those students who had a partially or totally online course, since it uses variables available only for these students. The only two significant contributors to predicting final grade in these courses (Table 6-6) are SAT Verbal score and agreement that taking online courses is more convenient. However, it should be noted that even with twelve predictors in the equation, we cannot accurately predict final course grades, with only 14% of the variance explained.

The most important equation for our purposes is the prediction of overall rating of the Virtual Classroom (Table 6-7). The total proportion of variance explained by the 18 predictor variables is a respectable 67%. The significant predictors are SAT Math scores, and perceptions that the Virtual Classroom is more convenient than the traditional classroom, that it increased access to the professor, and that the student was more involved in taking an active part in the course.

In a stepwise multiple regression approach to predicting overall VC ratings (not included here), the order of selection was feeling more involved in the course, feeling that the VC is more convenient, perception of better access to the professor, and the SAT Math score. These four variables accounted for 60% of the variance (adjusted R squared).

SUMMARY: PREDICTING STUDENT REACTIONS TO THE VIRTUAL CLASSROOM

"Course" is a much stronger predictor of differences in course outcomes than is mode of delivery. Bound up with course are differences in characteristics of the students enrolled, in the subject matter and thus content of the experiences, and especially, differences in teacher style or skill in various modes.

Our primary interest in this chapter was in pursuing the question of correlates of relatively "good" outcomes in Virtual Classroom courses. Some student characteristics, such as Math SAT scores, are strong predictors of relatively good outcomes. Convenience of access is also very important, as is regular and active participation, and a perception of improved access to the professor. These latter two variables, while partially related to student characteristics such as self-discipline, could also be greatly affected by how the instructor conducts the online course.

TABLE 6-5

Predicting Course Rating: Multiple Regression

Variable	b	Beta	T	SigT
Course = STATISTICS	10.93	0.81	4.78	0.000
SCHOOL	-6.93	-0.73	-3.72	0.000
SAT MATH SCORE	-0.02	-0.68	-4.68	0.000
Mode = MIXED	5.00	0.50	3.23	0.002
Course = SOC 150	7.23	0.48	3.09	0.002
Course = CIS 213	2.90	0.24	1.89	0.061
SAT VERBAL SCORE	0.01	0.18	1.82	0.071
ACADEMIC STANDING	0.60	0.17	1.62	0.109
Mode = ONLINE	1.50	0.16	1.54	0.126
Course = MATH 305	-0.58	-0.05	-0.40	0.693
(Constant)	26.46	---	6.53	0.000

Multiple R = 0.52   Adjusted R Square = 0.21

DF (10,121)   F = 4.53   p = 0.001

Note: Low Course Rating scores correspond to favorable ratings

TABLE 6-6

Predicting Final Grade for VC Students : Multiple Regression

Variable	b	Beta	T	SigT
SAT VERBAL SCORE	0.00	0.296	2.21	0.028
CONVENIENT	-0.18	-0.270	-2.07	0.041
INCREASED MOTIVATION	-0.11	-0.162	-1.40	0.165
ACCESS PROBLEM	-0.15	-0.155	-1.40	0.166
TOTAL TIMES ONLINE	0.00	0.119	1.07	0.288
ACADEMIC STANDING	0.09	0.099	0.97	0.337
ASSIGNMENTS USEFUL	0.08	0.098	0.69	0.490
MORE INVOLVED	-0.06	-0.078	-0.60	0.552
EIES EXPECTATIONS	-0.01	-0.068	-0.63	0.531
ACCESS PROFESSOR	-0.04	-0.053	-0.43	0.669
SAT MATH SCORE	0.00	0.025	0.17	0.863
COMMENTS USEFUL	-0.00	-0.006	-0.04	0.967
(Constant)	2.61	---	2.48	0.015

Multiple R = 0.49   Adjusted R sq = 0.14

DF (12,86) F = 2.29 p = 0.001

TABLE 6-7

Predicting Overall VC Rating : Multiple Regression

Variable	b	Beta	T	SigT
SAT MATH SCORE	0.01	0.29	1.96	0.053
CONVENIENT	-0.92	-0.28	-2.65	0.010
ACCESS PROFESSOR	-0.78	-0.24	-2.65	0.010
MORE INVOLVED	-0.79	-0.22	-2.22	0.029
Course = MANAGEMENT	-2.18	-0.16	-0.41	0.684
Course = CIS 213	-2.66	-0.16	-0.49	0.626
ASSIGNMENTS USEFUL	-0.42	-0.11	-1.08	0.284
Course = MATH 305	-1.67	-0.10	-0.31	0.759
ACADEMIC STANDING	-0.46	-0.10	-1.06	0.292
COMMENTS USEFUL	-0.35	-0.09	-0.97	0.337
INCREASED MOTIVATION	-0.27	-0.08	-0.99	0.327
EIES EXPECTATION	0.05	0.08	0.98	0.332
TOTAL TIMES ONLINE	-0.01	-0.07	-0.94	0.351
Course = SOC 150	-1.45	-0.07	-0.75	0.455
Course = STATISTICS	-1.03	-0.06	-0.56	0.581
SCHOOL	-0.46	-0.04	-0.10	0.921
SAT VERBAL SCORE	0.00	0.02	0.21	0.836
ACCESS PROBLEM	0.03	0.01	0.06	0.951
(Constant)	24.35	---	2.44	0.017

Multiple R = 0.82 Adjusted R sq = 0.67

DF (18,79) F = 8.82 p = 0.001

"Course" is a much stronger predictor of differences in course outcomes than is mode of delivery. Bound up with course are differences in characteristics of the students enrolled, in the subject matter and thus content of the experiences, and especially, differences in teacher style or skill in various modes.

Our primary interest in this chapter was in pursuing the question of correlates of relatively "good" outcomes in Virtual Classroom courses. Some student characteristics, such as Math SAT scores, are strong predictors of relatively good outcomes. Convenience of access is also very important, as is regular and active participation, and a perception of improved access to the professor. These latter two variables, while partially related to student characteristics such as self-discipline, could also be greatly affected by how the instructor conducts the online course.

CHAPTER 7

SUMMARY AND CONCLUSION

Despite a far-from-perfect implementation, the results of this field trial were generally positive, in terms of supporting the conclusion that the Virtual Classroom mode of delivery can increase access to and the effectiveness of college-level education.

Let us review the hypotheses and the findings. Originally, there was an hypothesis that the mixed mode results would not simply represent an "average" of the VC and TC modes, but might have some unique advantages and disadvantages. In the following summary, results related to this speculation are included in reviewing each of the other hypotheses.

H1: There will be no significant differences in scores measuring MASTERY of material taught in the virtual and traditional classrooms.

Finding: No consistent differences. In one of five courses, VC final grades were significantly better.

This hypothesis was tested using a quasi-experimental design which compared the midterm exam scores, final exam scores, and final grades attained by students in matched sections of five courses. In Computer Science, student performance tended to be significantly better, on the average, as measured by grades. Though there were no statistically significant differences for the two Freshman level courses in Sociology and Statistics, these were courses in which many students did D or F work in both modes, and the instructors tended to feel that the mode further disadvantaged young, poorly motivated students with marginal levels of reading, writing, and quantitative skills.

H2: The hypothesis that writing scores would improve more for students in a writing course with access to the Virtual Classroom than for students in similar courses who did not use the system, was NOT supported.

This may be because the measure used was not reliable or detailed enough. It showed no changes for students in a writing course in either the face-to-face or partially online modes.

H3: VC students will perceive it to be superior to the TC on a number of dimensions:

3.1 CONVENIENT ACCESS to educational experiences (supported).

3.2 Increased PARTICIPATION in a course (supported).

3.3 Improved ability to apply the material of the course in new contexts and EXPRESS their own independent IDEAS relating to the material.

Finding: Increased confidence in expressing ideas was most likely to occur in the mixed modes courses.

3.4 Improved ACCESS to their PROFESSOR (supported).

3.5 Increased level of INTEREST in the subject matter, which may carry beyond the end of the course.

Finding: This was course dependent. Though the averages for measures of increased interest are higher for both the VC and Mixed modes, the overall scores are not significantly different. Interest Index scores were highest for the VC mode at NJIT and for the Mixed mode courses at Upsala.

3.6 Improved ability to SYNTHESIZE or "see connection among diverse ideas and information."

Finding: No significant differences overall; mode interacts with course.

3.7 COMPUTER COMFORT- improved attitudes toward the use of computers and greater knowledge of the use of computers (supported).

3.8 Improved ability to communicate with and cooperate with other students in doing classwork (Group COLLABORATION Skills).

Findings: Mixed and course-dependent. Though 47% of all students in VC and Mixed modes courses felt that they had communicated more with other students than in traditional courses, 33% disagreed. The extent of collaborative learning was highest in the Mixed-mode courses.

3.9 Improved Overall QUALITY, whereby the student assesses the experience as being "better" than the TC in some way, involving learning more on the whole or getting more out of the course (supported).

Although the "average" results supported most of the above predictions, there was a great deal of variation, particularly among courses. Generally, whether or not the above outcomes occurred was dependent more on variations among courses than on variations among modes of delivery. The totally online upper level courses at NJIT, the courses offered to remote students, and the mixed mode courses were most likely to result in student perceptions of the virtual classroom being "better" in any of these senses.

H4: Those students who experience "group learning" in the virtual classroom are most likely to judge the outcomes of online courses to be superior to the outcomes of traditional courses.

Finding: Supported by both correlational analysis of survey data and qualitative data from individual interviews. Those students who experienced high levels of communication with other students and with their professor (who participated in a "group learning" approach to their coursework) were most likely to judge the outcomes of VC courses to be superior to those of traditionally delivered courses.

H5: High ability students will report more positive outcomes than low ability students.

Finding: Supported for Math SAT scores. Results for Verbal SAT scores much more mixed and inconsistent.

H6: Students with more positive pre-course attitudes towards computers in general and towards the specific system to be used will be more likely to participate actively online and to perceive greater benefits from the VC mode (supported).

H7: Students with a greater "sphere of control" on both the personal and the interpersonal levels will be more likely to regularly and actively particpate online and to perceive greater benefits from the VC mode.

Finding: Very weak support in terms of correlations with "Sphere of Control" indices from survey data. However, qualitative interview data indicate that inability to regularly devote time to online activities, to "make themselves" participate regularly when there is no externally imposed schedule of class meetings, was a common characteristic of students for whom VC outcomes were relatively poor.

H8: There will be significant differences in process and outcome among courses, when mode of delivery is controlled (Strongly supported. Course is a much stronger source of variance in outcomes than is Mode).

H9: Outcomes for the second offering of a VC course by an instructor will be significantly better than those for the first attempt at teaching online.

Findings: Although there was some tendency for this to be true, results were not consistently better on all measures for all second repetitions. Other factors, such as lower levels of skill or motivation among the students, may come into play.

Some courses may not be suited to this mode, and a second repetition of the totally online mode of delivery would not improve matters. The Introductory Sociology instructor came to this conclusion, as did the instructor for the required freshman-level course in Statistics at Upsala. Both felt that many of the freshmen, at least in the "computer-poor" Upsala environment, lacked the skills and the self-discipline to benefit from a totally online course. However, both instructors felt that the mixed-modes method of delivery could be superior, especially for upper-level courses which examine a small number of topics in depth.

H10: There will be significant differences between the Upsala and NJIT implementations of the Virtual Classroom, in terms of both process and outcomes of the online courses.

Finding: Supported. Results were better at NJIT for the totally online courses.

A Note on Costs

It is difficult to say how much it "costs" to offer online courses. The problem is with how one accounts for the costs of the central computer and its operation and maintenance. For instance, if you already have a mainframe and it is already being operated, then it really does not "cost" much more to add more users.

We can say something about the range of costs for the computing service. On EIES1, where this experiment was conducted, we were working with a totally dedicated Perkin-Elmer minicomputer. The machine cost about $400,000 and its expected life is five years or so. There are maintenance costs; the costs of approximately two full time technical people to keep the system operating, two full time administrative people who provide user support, plus student assistants and overhead. What we have done is priced the use of an account at a flat fee of $60.00 per month. At this rate, we are actually losing some money each year. This is within the context of a system with a capacity of 2000 users, in which about half are "free" because they are for internal university use.

EIES1 is an outmoded piece of software running on an outmoded piece of hardware. The new generation, TEIES, will run on IBM mainframes, and will support operating Virtual Classroom simultaneously with other applications. The "costs" and "prices" depend on the size of machine being used and the pricing strategy adopted to cover costs. We need to gain experience with loads and capacities on this hardware. What happens is that you get an economy of scale that favors the operation of shared utilities. We estimate that on an IBM mainframe configuration costing $400,000, the total capacity is about 1,000 active accounts. On the other hand, on a mainframe configuration costing about $600,000, we estimate that the capacity is about 10,000 active accounts. In the former case, amortizing the initial costs of the hardware over an expected life of ten years, yields a cost of about $60 a year per student for hardware, plus shares of maintenance and operational costs. Operational costs depend upon the level of support given to users. In the case of the large mainframe, hardware costs amortized over ten years would be only about $10 a year per student.

In fact, the main "costs" of this mode of delivery are the initial efforts by the instructors to prepare and offer a course online for the first time. Secondly, it can be costly to provide assistants who are available in person or by phone to help at any time. Thirdly, for remote students, telecommunications are a high part of the cost. With TELENET rates at $9.50 per hour daytimes and $3.00 per hour during the evenings, spending 100 hours online for a course can add up to a considerable sum. We recommend that students bear the costs of telecommunication, just as they bear the costs of commuting to a traditional course. This will motivate them to use off-peak rather than expensive prime time, and to use uploading and downloading to minimize connect time. Another approach is to give each student an allocation of "X" free hours; after that, they would have to pay for additional hours of use of TELENET or similar packet-switched networks to reach the Virtual Classroom.

One may better understand the elasticity of connect time by re-examining the data on connect times by course. The NJIT CIS students, who had unlimited connect time, often at 9600 baud on a local area network, spent an average of seventy five hours online. Each session generally averaged one half hour; obviously, many went well over an hour. The Connected Education students, who were reaching the Virtual Classroom via TELENET and who had to handle their local phone charges to reach a TELENET node, managed to complete an entire course with a much lower rate of actual connect time: thirteen hours, on the average, with an average session of under twenty minutes.

Thus, one of the strategies for minimizing costs must be to have students use a microcomputer for composing and displaying material locally, when they are coming into the system remote, rather than burning up hours with remote text input. Our new microcomputer package, Personal TEIES, is designed to support a mode of operation whereby it is simple and automatic to decide to upload and download items between the local PC and the central conferencing system, and thus to minimize actual connect time.

Modes of Use of The Virtual Classroom

There are several modes of employment of the Virtual Classroom. It can be used in a "mixed modes" manner on a local campus, to support a quarter to three quarters of the coursework for classes which also have some face-to-face meetings. This "adjunct" or "mixed" mode seems appropriate for a wide range of courses, including lower level courses. It can be used to deliver totally online courses, to remote or distance education students and/or students who are taking other courses at a campus in a traditional classroom. For totally online courses, it is recommended that the material be at a sophomore or higher level, or else that students be screened very carefully, to advise those with poor study skills against an introductory course offered online.

VC can also be used, very fruitfully, for remote education at the graduate level, or for continuing professional education of employees within organizations. Though not the purview of this project, the application area of continuing professional education may be the biggest "market" for Virtual Classroom in the long run. Such courses typically enroll mature, motivated students; focus on a few related topics; and have students for whom convenience of access would be very important.

The two year program of the Western Behavioral Sciences Institute provides one model of the use of the VC for executive education. There are four six-month terms, and at the beginning of each term there is a one-week residential seminar in La Jolla. Each term is divided into month-long seminars on specific topics, while a number of conferences and activities (such as small informal discussions groups of about ten) are continuous. At the end of the two-year program, about three quarters of the participants elect to remain in the network as alumni Fellows. The WBSI president, Richard Farson (1987) notes the following major advantages of online education:

> A program of depth and intensity, without removing the executive from his job for extended periods of time...
>
> The network permits the executive to form a genuine learning community on a relatively permanent basis, to sustain them throughout their careers.

Certainly, one aspect of the Connect-Ed and WBSI programs which should be emulated in future projects is that students take more than a single course online. Just as the instructors tended to improve their ability to work in this new environment with repitition, so it may be expected that students can improve their ability to use the technology effectively on the basis of experience.

Qualitative Outcomes and Overall Conclusions

In many cases, results of the quantitative analysis are inconclusive in determining which is "better," the VC mode or the TC mode. The overall answer is, "it depends." Results are superior for well-motivated and well-prepared students who have adequate access to the necessary equipment and who take advantage of the opportunities provided for increased interaction with their professor and with other students, and for active participation in a course. Students lacking the necessary basic skills and self-discipline will do better in a traditionally delivered course.

The "verdict" on virtual classroom comes down, in the end, to the qualitative reactions of students and instructors who were stimulated by this new type of learning environment. For example, here is the text of a message from a student in the Management Laboratory, sent after the course was officially over:

> Roxanne, I just completed Enrico's 471 class here on EIES. I felt that I should give you what I feel about the class and what it has done. It was the most stimulating, fascinating, educational and social experience I have ever had! From the subject itself to how it was presented to the activity and enthusiasm of this class, it was beyond words. I feel that the method of how it was presented here, on the system, had more than a great deal to do with it. It also had to do with Enrico's abilities as well as a bunch of very energetic people who were able to excel in his or her own way thru the extended class on the system.
>
> A lot of what happened, the massive activity in the conferences, the massive amount of time spent online by each participant, and the new, good and lasting friendships that developed (AND THERE ARE A LOT OF THOSE) will never be given justice in whatever the results of this project are, but they are what was really meaningful in this course. A great deal of learning was accomplished concerning the topic and a lot of other ideas. Learning that would not have been so great and varied as it was (without the system).
>
> I am not the only person who feels this way; its shared by most of the class...
>
> I have never dreaded so much the end of a semester and I hope that the group that formed and its cohesiveness that was so strong will continue afterwards. I don't want to belabor the point, but do want to emphasize what a great thing it was and hope to see it continue for a long time to come because the quality of the educational experience is greatly increased not only for the subject matter, but on a social level as well.
>
> Thanks for giving us this chance.

Essentially, that's what the Virtual Classroom software provides-- a chance to participate in a different kind of learning experience, one based on an active learning community working together to explore the subject area of a course. Note that the Management Laboratory was referred to above as "officially" over. Several months after the grades had been turned in, the class conference was still active, with over a hundred new entries which continued to discuss the issues raised in the course. This type of behavioral indicator of development of a high level of interest in learning validates the responses of students to questionnaire items.

The VC is not without its disadvantages, and it is not the preferred mode for all students (let alone all faculty). Students (and faculty) report that they have to spend more time on a course taught in this mode than they do on traditional courses. Students also find it more demanding in general, since they are asked to play an active part in the work of the class on a daily basis, rather than just passively taking notes once or twice a week. For students who want to do as little work as possible for a course, the Virtual Classroom tends to be perceived as an imposition rather than an opportunity. The VC is also not recommended for students who are deficient in basic reading, writing, and computational skills.

We have noted that increased interaction with the professor and with other students is the key to superior results in the Virtual Classroom. Thus, the selection and orientation of instructors who can orchestrate such collaborative learning environments becomes the key to success. The second volume of this report focusses on the issue of effective online teaching techniques.

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IDENTIFYING INFORMATION

This page will be removed from the questionnaire as soon as we have put identifying codes on the other pages, in order to protect the confidentiality of your responses.

NAME____

ADDRESS____

CITY, STATE, ZIPCODE___________________________

STUDENT ID NUMBER:____________________________

HOME TELEPHONE:_______________________________

DATE:____

BASELINE QUESTIONNAIRE FOR STUDENTS
VIRTUAL CLASSROOM PROJECT

COURSE NAME: ____________________________
COURSE NUMBER AND SECTION: _______________
INSTRUCTOR: _____________________________

Mode - Mode in which class was presented X=1.91 SD=0.84 N=372
(1) 40% Completely Online
(2) 28% Partially Online
(3) 32% All Offline

SCHOOL - X=1.60 SD=0.86 N=332
I am:
(1) 58% An NJIT student
(2) 32% Upsala student
(3) 4% New School (Connect Ed) student
(4) 7% Other_____________________

SOME BACKGROUND INFORMATION

If you feel that any of these items invade your privacy, you are of course free to decline to answer them.

How important are each of the following reasons for your taking this course and this particular section or mode of delivery of the course? Very Important, Somewhat Important, or Not Important?

	Very Important	Somewhat Important	Not Important	X	SD	N
PROFESSIONAL INTEREST I have a professional or job- related interest in the topic	32%	46%	22%	1.89	0.73	331
GENERAL INTEREST I have a general interest in the topic	32%	57%	10%	1.78	0.62	329
REQUIRED MAJOR Required for my major	47%	74%	100%	1.78	0.83	326
REQUIRED COURSE Required for graduation	56%	22%	22%	1.66	0.82	325
INSTRUCTOR'S REPUTATION The reputation of the instructor	22%	40%	37%	2.15	0.76	316
NO CHOICE No choice- transfer to other sections impossible	5%	14%	82%	2.77	0.52	303

	Very Important	Somewhat Important	Not Important	X	SD	N
CURIOUS						
I was curious about how the technology works	32%	48%	21%	1.89	0.72	326
CONVENIENCE						
More convenient than traditional classes	26%	33%	41%	2.15	0.81	318

EXPECTED GRADE
What grade do you expect to receive in this Course?
55% A 39% B 6% C .3% D X=1.51 SD=.62 N=321

EXPECTED DIFFICULTY X=3.44 SD=.90 N=331
How easy or difficult do you expect this course to be?

EASY :	1 :	2 :	3 :	4 :	5	: DIFFICULT
	3%	10%	39%	38%	11%	

SEX
Your sex: 71% Male 29% Female X=1.29 SD=0.46 N=327

AGE X=23.77 SD=6.78 N=320
Your age at last birthday:

17,18	13%
19-	10%
22-25-	27%
26-34	18%
35+-	6%

MAJOR
Your major:

NATIONALITY X=1.43 SD=.50 N=250
Nationality:
(1) 57% USA
(2) 43% OTHER

ETHNIC GROUP
Ethnic/Racial Background
14% Black/Afro-American
7% Hispanic (Mexican, Puerto-Rican, etc.)
66% White
12% Asian or Asian-American
1% Other

ENGLISH X=1.19 SD=.39 N=325
Is English your native or first language?
81% Yes 19% No

TYPING X=3.03 SD=.92 N=331
How would you describe your typing skills?

(1) 4% None
(2) 22% Hunt and peck
(3) 46% Casual (rough draft with errors)
(4) 22% Good (can do 25 w.p.m. error free)
(5) 6% Excellent (can do 40 w.p.m. error free)

ACADEMIC STANDING X=2.99 SD=1.31 N=321
Academic standing

16% Freshman
20% Sophomore
31% Junior
21% Senior
11% Master's candidate
2% Doctoral candidate
1% Post-doctoral

PREVIOUS ONLINE X=1.15 SD=.47 N=130
How many online ("virtual classroom") courses have you taken previously?

(1) 90% None. This is my first online course
(2) 5% One
(3) 5% Two or more

IMAGES OF YOURSELF

Please read each of the following and indicate how much you agree or disagree (1= Completely DISAGREE: 7 means Completely AGREE).

	DISAGREE						AGREE			
	1	2	3	4	5	6	7	X	SD	N
WORK HARD When I get what I want it's usually because I worked hard for it	0%	1%	4%	8%	21%	36%	30%	5.76	1.15	331
GROUP EASY I find it easy to play an important part in most group situations	1%	5%	11%	24%	28%	20%	11%	4.75	1.38	329
PREFER LUCK I prefer games involving some luck over games requiring pure skill	14%	19%	18%	22%	14%	8%	4%	3.43	1.66	326
POOR SOCIAL CONTROL Even when I'm feeling self-confident about most things, I still seem to lack the ability to control social situations	14%	29%	17%	18%	14%	7%	1%	3.15	1.56	324
LEARN ANYTHING I can learn almost anything if I set my mind to it	0%	1%	1%	4%	15%	30%	48%	6.17	1.04	330
MAKING FRIENDS I have no trouble making and keeping friends	0%	1%	4%	8%	17%	27%	43%	5.93	1.22	328

	DISAGREE 1	2	3	4	5	6	AGREE 7	X	SD	N
POINTLESS It's pointless to keep working on something that is too difficult for me	27%	29%	13%	13%	8%	5%	4%	2.80	1.70	328
CONVERSATIONS I'm not good at guiding the course of a conversations with several others	22%	25%	17%	15%	12%	6%	2%	2.95	1.61	329
COMPARISONS On any sort of exam or competition I like to know how well I do relative to everyone else	8%	5%	7%	13%	16%	27%	24%	4.99	1.86	328
CLOSE RELATIONSHIPS I can usually establish a close personal relationship with someone I find attractive	5%	2%	9%	18%	21%	24%	21%	5.07	1.60	327
ABILITY My major accomplishments are entirely due to my hard work and ability	0%	1%	2%	6%	20%	37%	34%	5.92	1.06	328
MAKING PLANS When I make plans I am almost certain to make them work	0%	2%	4%	14%	28%	31%	21%	5.43	1.22	330
STEER INTERVIEWS When being interviewed I can usually steer the interviewer toward the topics I want to talk about and away from those I wish to avoid	3%	7%	15%	29%	23%	15%	6%	4.33	1.43	326
SETTING GOALS I usually don't set goals because I have a hard time following through on them	32%	34%	16%	8%	5%	3%	1%	2.34	1.41	328
GETTING HELP If I need help in carrying off a plan of mine, it's usually difficult to get others to help	21%	24%	21%	17%	8%	7%	2%	2.94	1.57	327
COMPETITION Competition discourages excellence	47%	20%	10%	9%	7%	3%	3%	2.32	1.68	329

	DISAGREE						AGREE			
	1	2	3	4	5	6	7	X	SD	N
MEETING PEOPLE If there's someone I want to meet I can usually arrange it	3%	5%	10%	23%	20%	20%	18%	4.86	1.58	329
OTHERS LUCKY Other people get ahead just by being lucky	22%	26%	17%	20%	9%	3%	3%	2.88	1.55	328
POINT OF VIEW I often find it hard to get my point of view across to others	20%	29%	20%	15%	9%	4%	2%	2.84	1.53	330
DISAGREEMENTS In attempting to smooth over a disagreement I usually make it worse	30%	31%	18%	13%	5%	1%	2%	2.45	1.42	327

YOUR PREVIOUS EXPERIENCE WITH COMPUTERS

COMPUTER EXPERIENCE X=2.23 SD=.94 N=331

Which of the following best describes your previous experience with computer systems?

(1)22% I am a NOVICE; seldom or never use computers
(2)45% I have OCCASIONALLY used computer terminals and systems before
(3)22% I have FREQUENTLY used computer systems
(4)11% Use of computers is central to my PROFESSIONAL work

For each of the following pairs of words, please circle the response that is closest to your CURRENT FEELINGS ABOUT USING COMPUTERS. For instance, for the first pair of words, if you feel computer systems in general are completely "stimulating" to use and not at all "dull," circle "1"; "4" means that you are undecided or neutral or think they are equally likely to be stimulating or dull; "3" means you feel that they are slightly more stimulating than dull, etc.

		1	2	3	4	5	6	7		X	SD	N
DULL-1	Stimulating	23%	24%	21%	21%	5%	2%	3%	Dull	2.82	1.52	325
DREARY-1	Fun	22%	27%	23%	15%	8%	2%	3%	Dreary	2.78	1.49	327
DIFFICULT-1	Easy	7%	15%	18%	27%	16%	12%	5%	Difficult	3.82	1.57	327
IMPERSONAL-1	Personal	6%	10%	13%	36%	11%	13%	11%	Impersonal	4.20	1.63	324
HELPFUL-1	Hindering	4%	2%	5%	15%	16%	31%	27%	Helpful	5.35	1.58	323
UNTHREATENING-1	Threatening	4%	6%	6%	26%	12%	21%	26%	Unthreatening	5.02	1.68	325
INEFFICIENT-1	Efficient	38%	30%	15%	10%	2%	2%	2%	Inefficient	2.21	1.37	323
OBLIGING-1	Demanding	12%	12%	13%	40%	11%	8%	4%	Obliging	3.65	1.54	323
UNRELIABLE-1	Reliable	24%	27%	22%	18%	4%	2%	3%	Unreliable	2.70	1.46	326
UNDESIRABLE-1	Desirable	25%	26%	16%	23%	3%	3%	4%	Undesirable	2.77	1.57	327

EXPECTATIONS ABOUT THE EIES SYSTEM
[Skip this section if you are not going to use EIES]

Indicate your expectations about how it will be to use this system by circling the number which best indicates where your feelings lie on the scales below.

EASY-1

4%	6%	14%	25%	19%	20%	11%
1	2	3	4	5	6	7
Hard to learn						Easy to learn

X=4.54 SD=1.58 N=246

FRIENDLY-1

4%	7%	8%	24%	28%	20%	9%
1	2	3	4	5	6	7
Impersonal						Friendly

X=4.60 SD=1.52 N=244

NOT FRUSTRATING-1

4%	10%	16%	24%	21%	21%	9%
1	2	3	4	5	6	7
Frustrating						Not frustrating

X=4.32 SD=1.59 N=245

PRODUCTIVE-1

2%	1%	5%	18%	24%	34%	16%
1	2	3	4	5	6	7
Unproductive						Productive

X=5.27 SD=1.29 N=244

EFFICIENCY-1
Do you expect that use of the System will increase the efficiency of your education (the quantity of work that you can complete in a given time)?

19%	21%	14%	24%	15%	5%	2%
1	2	3	4	5	6	7
Definitely yes				Unsure		Definitely not

X=3.00 SD=1.55 N=245

QUALITY-1
Do you expect that use of the System will increase the quality of your education?

21%	22%	18%	25%	6%	4%	3%
1	2	3	4	5	6	7
Definitely yes		Unsure				Definitely not

X=5.48 SD=1.74 N=242

RESENT-1
I resent being required to use EIES for this course.

4%	3%	6%	19%	7%	17%	43%
1	2	3	4	5	6	7
Definitely yes		Unsure				Definitely not

X=2.76 SD=1.46 N=243

OVERALL-1
Overall, how useful do you expect the System to be for online classes?

23%	27%	20%	19%	6%	3%	2%
1	2	3	4	5	6	7
Very Useful						Not useful at all

X=3.37 SD=1.08 N=237

EXPECTED TIME X=3.37 SD=1.08 N=237
While you are part of an online course,
how much time in the average week do you foresee yourself using EIES in relation to your coursework?

(1) 4% Less than 30 minutes
(2) 12% 30 minutes to 1 hour
(3) 43% 1 - 3 hours
(4) 29% 4 - 6 hours
(5) 7% 7 - 9 hours
(6) 5% 10 hours or more

EQUIPMENT ACCESS

Please describe your access to a computer terminal or microcomputer at your office or place of work.

WORK ACCESS X=3.00 SD=1.66 N=264
(1) 28% No terminal
(2) 21% Have my own terminal
(3) 10% Share a terminal, located where I can see it from my desk
(4) 8% Share a terminal, which takes ____ minutes to reach
(5) 33% Not applicable; I do not have an office

HOME ACCESS X=1.41 SD=0.49 N=267
Do you have a micro or terminal at home (or in your dorm, wherever you live during classes)?
(1) 59% No
(2) 41% Yes

TERMINAL TYPE X=2.04 SD=0.94 N=200
What kind of terminal do you usually use? (Check all that apply)

42% CRT (video display)
11% Hard copy (printer terminal)
46% Both

MICRO

40% Microcomputer (Brand:__________)

  25% With modem

  26% With hard copy

  34% With disk storage

If you know the name of your communications software (e.g., Smartcom), please list it here:__________________________

THANK YOU VERY MUCH !!!

POST-COURSE QUESTIONNAIRE FOR STUDENTS
VIRTUAL CLASSROOM PROJECT

COURSE NAME: ______________________________
COURSE NUMBER AND SECTION: ______________
INSTRUCTOR: ____________________________
YOUR STUDENT ID: ________________________

COURSE EFFECTIVENESS

There are three sets of items in this section; we would like you to try to separate them out in your thinking. The first relates to the teaching or presentation style and effectiveness of your instructor; the second, to the course content; and the third, to the outcomes of the course for you. Later in the questionnaire, those who participated in an experimental mode of delivery will make direct comparisons between this course and traditional courses.

For each of the following, please circle a response that corresponds to the following scale:

SA= Strongly Agree
A= Agree
N= Neither agree nor disagree (neutral)
D= Disagree
SD= Strongly Disagree

COURSE CONTENT

	SA	A	N	D	SD	X	SD	N
CONTENT INTERESTING The course content was interesting to me	20%	63%	12%	4%	0%	2.01	0.72	283
CONTENT IMPORTANT Course content is important or valuable	25%	58%	14%	2%	1%	1.96	0.74	283
GOALS CLEAR Course goals were clear to me	16%	59%	19%	6%	1%	2.18	0.80	282
REQUIREMENTS CLEAR Work requirements and grading system were clear from the beginning	26%	46%	19%	6%	2%	2.11	0.93	283
READINGS POOR The reading assignments are poor	4%	8%	25%	48%	15%	3.63	0.96	283
WRITTEN ASSIGN. POOR The written assignments are poor	2%	4%	28%	49%	17%	3.74	0.87	281
LECTURES POOR The lecture material is poor	2%	5%	14%	51%	27%	3.95	0.92	279

	SA	A	N	D	SD	X	SD	N
WORK HARD The students had to work hard	18%	45%	29%	7%	1%	2.28	0.88	283
WASTE OF TIME This course was a waste of time	2%	4%	14%	32%	49%	4.21	0.96	282

APPROPRIATE LEVEL X=3.18 SD=0.63 N=280
Is this course taught at an appropriate level?

1%	8%	68%	21%	3%
1	2	3	4	5
Too easy		Just right		Too difficult

COURSE OVERALL X=2.48 SD=0.97 N=265
How would you rate this course over-all?

(1)Excellent	(2)Very good	(3)Good	(4)Fair	(5)Poor
16%	37%	34%	11%	3%

COMMENTS ABOUT THE COURSE CONTENT?
Yes Comment : 16%
No Comment : 84%

CHARACTERISTICS OF THE TEACHING

	SA	A	N	D	SD	X	SD	N
WELL ORGANIZED Instructor organized the course well	31%	55%	10%	2%	1%	1.89	0.79	280
GRADING FAIR Grading was fair and impartial	29%	50%	18%	2%	1%	1.97	0.80	276
ENJOYS TEACHING Instructor seems to enjoy teaching	50%	39%	9%	1%	0%	1.64	0.74	277
LACKS KNOWLEDGE Instructor lacks sufficient knowledge about the subject area	2%	4%	5%	29%	59%	4.38	0.95	279
IDEAS ENCOURAGED Students were encouraged to express ideas	40%	48%	9%	3%	0%	1.74	0.73	280
PRESENTED CLEARLY Instructor presented material clearly and summarized main points	27%	55%	14%	3%	1%	1.95	0.79	280

	SA	A	N	D	SD	X	SD	N
OTHER VIEWS Instructor discussed points of view other than her/his own	25%	52%	20%	4%	0%	2.02	0.77	279
PERSONAL HELP The student was able to get personal help in this course	27%	45%	23%	3%	1%	2.06	0.86	278
INSTRUCTOR BORING Instructor presented material in a boring manner	2%	6%	21%	45%	26%	3.85	0.95	277
HELPFUL CRITIQUE Instructor critiqued my work in a constructive and helpful way	17%	48%	30%	3%	2%	2.25	0.84	279

TEACHER OVERALL X=1.87 SD=0.90 N=279
Overall, I would rate this teacher as

(1)Excellent	(2)Very good	(3)Good	(4)Fair	(5)Poor
40%	38%	16%	4%	1%

COMMENTS ABOUT THE INSTRUCTOR OR THE TEACHING?
Yes Comment : 26%
No Comment : 74%

OUTCOMES OF THE COURSE

	SA	A	N	D	SD	X	SD	N
MORE INTERESTED I became more interested in the subject	18%	52%	21%	6%	2%	2.22	0.90	283
LEARNED FACTS I learned a great deal of factual material	12%	62%	20%	5%	1%	2.20	0.74	283
CONCEPTS I gained a good understanding of basic concepts	16%	68%	11%	4%	1%	2.05	0.71	282
CENTRAL ISSUES I learned to identify central issues in this field	12%	61%	22%	3%	2%	2.21	0.76	281
COMMUNICATED CLEARLY I developed the ability to communicate clearly about this subject	13%	50%	31%	3%	2%	2.30	0.81	283
CRITICAL THINKING My skill in critical thinking was increased	12%	50%	32%	5%	2%	2.34	0.82	283
ETHICAL ISSUES I developed an understanding of ethical issues	8%	39%	42%	8%	4%	2.61	0.87	280
GENERALIZATIONS My ability to integrate facts and develop generalizations improved	10%	51%	30%	7%	1%	2.29	0.82	280
COMPLETED READINGS I regularly completed the required readings	20%	43%	23%	12%	3%	2.35	1.02	280
DID ADDITIONAL READING I was stimulated to do additional reading	7%	23%	42%	23%	5%	2.98	0.97	282
PARTICIPATED I participated actively in class discussion	18%	42%	30%	8%	1%	2.32	0.91	279
DISCUSS OUTSIDE I was stimulated to discuss related topics outside of class	12%	38%	32%	16%	2%	2.58	0.96	283

	SA	A	N	D	SD	X	SD	N
WRITTEN AIDED The written assignments aided my learning	21%	53%	21%	3%	2%	2.12	0.83	281
COMPLETED WRITTEN I regularly completed the written assignments	26%	55%	13%	5%	1%	2.00	0.81	283
THINK FOR SELF I was forced to think for myself	24%	60%	13%	1%	1%	1.93	0.69	283
EXPRESSING IDEAS I became more confident in expressing my ideas	18%	47%	30%	3%	1%	2.23	0.83	283
NEW FRIENDSHIPS I developed new friendships in this class	19%	51%	21%	5%	4%	2.25	0.96	283
VALUE OTHERS VIEWS I learned to value other points of view	14%	52%	29%	3%	2%	2.27	0.81	282
DID BEST WORK I was motivated to do my best work	19%	51%	25%	4%	1%	2.12	0.84	283
SELF UNDERSTANDING I gained a better understanding of myself	10%	39%	43%	5%	4%	2.53	0.87	281
COMPUTER COMPETENCE I increased my competence with computers	18%	42%	24%	8%	8%	2.45	1.11	281
RELATIONSHIPS I learned to see relationships between important topics and ideas	13%	53%	30%	2%	2%	2.28	0.79	282
CRITICAL ANALYSIS My ability to critically analyze written material was improved	10%	45%	36%	7%	1%	2.46	0.82	283

GENERAL INFORMATION

TOTAL TIME
About how much TOTAL time have you spent each week on this course? (including "in class" and out, reading and writing, on and offline)

(1) 1% Less than one hour
(2) 11% 1-2 hours
(3) 34% 3-4 hours
(4) 38% 5-9 hours
(5) 16% Ten hours or more

N= 275 Mean= 3.6 SD= 0.9

EASY COURSE
How easy or difficult was this course for you?

	3%	15%	46%	28%	7%	
EASY:	1	2	3	4	5	:DIFFICULT

N= 274 Mean= 3.2 SD= 0.9

EXPECTED GRADE
What grade do you expect to receive in this course?

36% A 43% B 16% C 4% D 0% F

N= 273 Mean= 1.9 SD= 0.8

Individual vs. Group Learning

Some courses are essentially a very INDIVIDUAL experience; contact with other students does not play an important part in your learning. In other courses, communication with other students plays a dominant role. For THIS COURSE, please circle the number below that seems to be what you experienced.

GROUP EXPERIENCE

10%	16%	21%	16%	23%	12%
1	2	3	4	5	6
Individual experience					Group experience

N= 266 Mean= 3.6 SD= 1.6

MISLEADING HELP
The help I got from other students was---

6%	26%	36%	17%	11%	5%
1	2	3	4	5	6
Crucially important to me					Useless or misleading

N= 274 Mean= 3.1 SD= 1.2

Students in my class tended to be

STUDENTS COOPERATIVE

1	2	3	4	5	6
1%	6%	16%	29%	34%	15%
Not at all cooperative					Extremely cooperative

N= 273 Mean= 4.3 SD= 1.1

STUDENTS COMPETITIVE

1	2	3	4	5	6
4%	16%	23%	34%	18%	5%
Not at all competitive					Extremely competitive

N= 257 Mean= 3.6 SD= 1.2

STUDENT COMMUNICATION
How often did you communicate with other students outside of class, by computer, "face-to-face" or on the telephone?

1	2	3	4	5	6
11%	20%	19%	27%	18%	6%
Never					Constantly

N= 274 Mean= 3.4 SD= 1.4

ATTITUDES TOWARD COMPUTERS

For each of the following pairs of words, please circle the response that represents where you fall on the scale in terms of your CURRENT FEELINGS ABOUT USING COMPUTERS.

DULL

1	2	3	4	5	6	7
22%	26%	24%	16%	6%	4%	3%
Stimulating						Dull

N= 265 Mean= 2.8 SD= 1.5

DREARY

1	2	3	4	5	6	7
22%	22%	28%	14%	7%	4%	3%
Fun						Dreary

N= 265 Mean= 2.9 SD= 1.5

DIFFICULT

1	2	3	4	5	6	7
11%	13%	19%	22%	20%	9%	6%
Easy						Difficult

N= 266 Mean= 3.8 SD= 1.7

IMPERSONAL

1	2	3	4	5	6	7
9%	11%	19%	28%	15%	9%	10%
Personal						Impersonal

N= 262 Mean= 3.9 SD= 1.7

HELPFUL

1	2	3	4	5	6	7
3%	4%	9%	14%	18%	29%	23%
Hindering						Helpful

N= 265 Mean= 5.2 SD= 1.6

UNTHREATENING

1	2	3	4	5	6	7
3%	6%	10%	20%	16%	21%	24%
Threatening						Unthreatening

N= 264 Mean= 5.0 SD= 1.7

INEFFICIENT

1	2	3	4	5	6	7
28%	27%	19%	17%	3%	2%	3%
Efficient						Inefficient

N= 263 Mean= 2.6 SD= 1.4

OBLIGING

1	2	3	4	5	6	7
12%	14%	20%	30%	10%	10%	5%
Demanding						Obliging

N= 261 Mean= 3.6 SD= 1.6

UNRELIABLE

1	2	3	4	5	6	7
18%	30%	18%	20%	6%	6%	2%
Reliable						Unreliable

N= 262 Mean= 2.9 SD= 1.5

UNDESIRABLE

1	2	3	4	5	6	7
27%	22%	16%	20%	7%	4%	4%
Desirable						Undesirable

N= 264 Mean= 2.9 SD= 1.7

ATTITUDES TOWARD MEDIA

To what extent do you agree with the following statements?

ENJOY LECTURES
I enjoy listening to lectures.

7%	25%	26%	21%	13%	6%	2%
1	2	3	4	5	6	7
Strongly Agree						Strongly Disagree

N= 87 Mean= 3.3 SD= 1.4

LIKE READING
I like to read.

10%	20%	25%	25%	5%	9%	6%
1	2	3	4	5	6	7
Strongly Agree						Strongly Disagree

N= 87 Mean= 3.4 SD= 1.6

DIFFICULTY WRITING
I have difficulty expressing my ideas in writing.

2%	9%	15%	13%	20%	28%	13%
1	2	3	4	5	6	7
Strongly Agree						Strongly Disagree

N= 86 Mean= 4.7 SD= 1.6

LIKE DISCUSSION
I like to take part in class discussions.

17%	30%	16%	17%	9%	8%	1%
1	2	3	4	5	6	7
Strongly Agree						Strongly Disagree

N= 86 Mean= 3.0 SD= 1.6

PARTICIPATION IN THE ONLINE COURSE

If you participated in a traditional course or a course which did not include any online work, skip the rest of the questionnaire.

ACCESS PROBLEM
Is access to a terminal or micro for the online class a problem for you?

1	2	3	4	5
7%	15%	19%	20%	39%
Serious Problem				Not a Problem

N= 176 Mean= 3.7 SD= 1.3

BUSY LINES
How much problem have you had with "busy" lines or no available ports to EIES?

1	2	3	4	5
6%	13%	23%	20%	38%
Serious Problem				Not a Problem

N= 173 Mean= 3.7 SD= 1.3

SLOW RESPONSE
To what extent has the slow response of the EIES system been a problem or barrier for you?

1	2	3	4	5
14%	19%	28%	22%	17%
Serious Problem				Not a Problem

N= 174 Mean= 3.1 SD= 1.3

EXPERIENCES WITH EIES

Indicate your experiences with using this system by circling the number which best indicates where your feelings lie on the scales below.

EASY TO LEARN-2

1	2	3	4	5	6	7
2%	6%	12%	9%	15%	35%	20%
Hard to learn						Easy to learn

N= 176 Mean= 5.2 SD= 1.6

FRIENDLY-2

1	2	3	4	5	6	7
5%	8%	10%	12%	19%	31%	15%
Impersonal						Friendly

N= 176 Mean= 4.8 SD= 1.7

NOT FRUSTRATING-2

1	2	3	4	5	6	7
4%	14%	13%	18%	17%	23%	10%
Frustrating						Not frustrating

N= 176 Mean= 4.4 SD= 1.7

PRODUCTIVE-2

1	2	3	4	5	6	7
3%	3%	8%	16%	20%	32%	16%
Unproductive						Productive

N= 176 Mean= 5.1 SD=1.5

INCREASE EFFICIENCY-2
Did use of the System increase the efficiency of your education (the quantity of work that you can complete in a given time)?

1	2	3	4	5	6	7
11%	18%	15%	23%	10%	15%	6%
Definitely yes			Unsure			Definitely not

N= 175 Mean= 3.7 SD= 1.8

INCREASE QUALITY-2
Did use of the System increase the quality of your education?

1	2	3	4	5	6	7
12%	22%	22%	22%	8%	6%	7%
Definitely yes			Unsure			Definitely not

N= 175 Mean= 3.4 SD= 1.7

COMPARISON TO TRADITIONAL CLASSROOMS

Please compare online "classes" to your previous experiences with "face to face" college- level courses. To what extent do you agree with the following statements about the comparative process and value of the EIES online course or portion of a course in which you participated? (Circle a number on the scales.)

CONVENIENT
Taking online courses is more convenient.

25%	24%	16%	12%	8%	8%	7%
1	2	3	4	5	6	7
Strongly Agree						Strongly Disagree

N= 175 Mean= 3.7 SD= 1.8

INHIBITED
I felt more "inhibited" in taking part in the discussion.

4%	10%	13%	29%	10%	21%	13%
1	2	3	4	5	6	7
Strongly Agree						Strongly Disagree

N= 179 Mean= 4.5 SD= 1.7

LESS WORK
I didn't have to work as hard for online classes.

3%	9%	9%	16%	20%	24%	19%
1	2	3	4	5	6	7
Strongly Agree						Strongly Disagree

N= 181 Mean= 4.9 SD= 1.7

COMMUNICATED MORE
I communicated more with other students in the class as a result of the computerized conference.

13%	21%	13%	19%	10%	12%	11%
1	2	3	4	5	6	7
Strongly Agree						Strongly Disagree

N= 179 Mean= 3.7 SD= 1.9

ACCESS PROFESSOR
Having the computerized conferencing system available provided better access to the professor(s).

18%	21%	19%	14%	10%	9%	8%
1	2	3	4	5	6	7
Strongly Agree						Strongly Disagree

N=179 Mean= 3.3 SD= 1.9

INCREASED MOTIVATION
The fact that my assignments would be read by the other students increased my motivation to do a thorough job.

16%	25%	14%	20%	6%	11%	8%
1	2	3	4	5	6	7
Strongly Agree						Strongly Disagree

N= 179 Mean= 3.4 SD= 1.8

STOP PARTICIPATING
When I became very busy with other things, I was more likely to stop participating in the online class than I would have been to "cut" a weekly face-to-face lecture.

15%	20%	14%	15%	8%	15%	14%
1	2	3	4	5	6	7
Strongly Agree						Strongly Disagree

N= 177 Mean= 3.8 SD= 2.0

MORE BORING
The online or virtual classroom mode is more boring than traditional classes.

8%	6%	8%	16%	17%	24%	21%
1	2	3	4	5	6	7
Strongly Agree						Strongly Disagree

N= 177 Mean= 4.8 SD= 1.8

MORE INVOLVED
I felt more "involved" in taking an active part in the course.

16%	22%	18%	18%	13%	6%	6%
1	2	3	4	5	6	7
Strongly Agree						Strongly Disagree

N= 177 Mean= 3.3 SD= 1.7

COMMENTS USEFUL
I found the comments made by other students to be useful to me.

11%	28%	20%	20%	10%	7%	4%
1	2	3	4	5	6	7
Strongly Agree						Strongly Disagree

N= 177 Mean= 3.3 SD= 1.6

ASSIGNMENTS USEFUL
I found reading the reviews or assignments of other students to be useful to me.

12%	24%	26%	21%	6%	7%	4%
1	2	3	4	5	6	7
Strongly Agree						Strongly Disagree

N= 177 Mean= 3.2 SD= 1.6

NOT CHOOSE ANOTHER
I would NOT choose to take another online course.

11%	9%	6%	11%	11%	19%	34%
1	2	3	4	5	6	7
Strongly Agree						Strongly Disagree

N= 176 Mean= 4.9 SD= 2.1

BETTER LEARNING
I found the course to be a better learning experience than normal face-to-face courses.

17%	16%	14%	25%	8%	10%	10%
1	2	3	4	5	6	7
Strongly Agree						Strongly Disagree

N= 177 Mean= 3.6 SD= 1.9

LEARNED MORE
I learned a great deal more because of the use of EIES.

11%	20%	14%	27%	9%	10%	8%
1	2	3	4	5	6	7
Strongly Agree						Strongly Disagree

N= 176 Mean= 3.7 SD= 1.8

TRADITIONAL MORE
I would have gotten more out of a traditional course.

12%	8%	4%	19%	16%	18%	22%
1	2	3	4	5	6	7
Strongly Agree						Strongly Disagree

N= 67 Mean= 4.6 SD= 2.0

OVERALL COMMENTS AND SUGGESTIONS

What one or two things about your virtual classroom experience did you like the best?

(1) 34% CONVENIENCE
(2) 16% ENJOY COMPUTERS
(3) 9% COMMUNICATE EASY
(4) 10% CLASS INTEREST
(5) 4% HARD COPY
(6) 1% READ HELPFUL N= 119
(7) 14% SHARE W/OTHERS
(8) 2% CATCH-UP EASY
(9) 2% SAY ANYTHING
(10) 7% SELF-PACED
(11) 1% ACCOMPLISH MORE

What one or two things about your virtual classroom experience were the "worst," the most in need of improvement?

(1) 33% SLOW EIES
(2) 14% NO ACCESS
(3) 4% HATE COMPUTERS
(4) 4% NO HELP
(5) 3% TIME CONSUMING
(6) 3% NEED DOCUMENTATION
(7) 5% HATE SELF-PACED
(8) 4% TOO MUCH WORK N= 103
(9) 3% MORE COORDINATION
(10) 4% TOO HARD
(11) 1% NO CATCH-UP
(12) 1% LESS MATERIAL
(13) 13% BRANCH PROBLEMS
(14) 3% OTHERS COPIED
(15) 2% TIME TESTS
(16) 3% MORE TRAINING
(17) 2% POOR GRAPHICS

Other comments or suggestions for improvements?

(1) 4% REDUCE WORK
(2) 7% EIES RESPONSE
(3) 9% MORE ONLINE
(4) 16% MORE TERMINALS
(5) 2% HELPS INDEPENDENCE
(6) 4% IMPROVES PEER RELATIONSHIPS
(7) 11% HINDERS INDEPENDENCE
(8) 11% NEED FACE-TO-FACE
(9) 4% HARD COPY N= 45
(10) 20% IMPROVE BRANCH
(11) 2% MORE DOCUMENTATION
(12) 4% OTHERS SHOULD READ
(13) 2% IMPROVE SCREENS
(14) 2% STANDARDIZE SOFTWARE

VIRTUAL CLASSROOM SOFTWARE FEATURES

How valuable or useless - and how well designed - do you currently find each of the following features or capabilities of EIES for online classes? (If you have not actually used a feature, please check "Cannot say" and skip to the next feature.) Use the space by each feature for any comments or suggestions.

PEN NAMES

Comments

10%	25%	21%	6%	7%	31%
1	2	3	4	5	___
Valuable				Useless	Cannot Say

N= 165 Mean= 2.7 SD=1.2

16%	31%	40%	8%	5%
1	2	3	4	5
Well Designed				Poorly Designed

N= 122 Mean= 2.6 SD=1.0

BRANCH- RESPONSE

15%	21%	20%	15%	8%	21%
1	2	3	4	5	___
Valuable				Useless	Cannot Say

N= 164 Mean= 2.7 SD= 1.2

12%	18%	32%	18%	20%
1	2	3	4	5
Well Designed				Poorly Designed

N= 131 Mean= 3.2 SD= 1.3

BRANCH- READ

10%	21%	17%	10%	4%	39%
1	2	3	4	5	
Valuable				Useless	Cannot Say

N= 163 Mean= 2.6 SD= 1.1

12%	23%	37%	19%	10%
1	2	3	4	5
Well Designed				Poorly Designed

N= 101 Mean= 2.9 SD= 1.1

QUIZ

38%	19%	6%	2%	0%	36%
1	2	3	4	5	
Valuable				Useless	Cannot Say

N= 64 Mean= 1.6 SD= 0.8

44%	27%	20%	7%	2%
1	2	3	4	5
Well Designed				Poorly Designed

N= 41 Mean= 2.0 SD= 1.1

RUNNING FORTRAN OR PASCAL COMPILERS

6%	6%	13%	5%	0%	70%
1	2	3	4	5	
Valuable				Useless	Cannot Say

N= 63 Mean= 2.5 SD= 1.0

21%	10%	37%	21%	10%
1	2	3	4	5
Well Designed				Poorly Designed

N= 19 Mean= 2.9 SD= 1.3

GRAPHICS-INPUT Comments

4%	8%	9%	4%	3%	72%
1	2	3	4	5	___
Valuable				Useless	Cannot Say

N= 160 Mean= 2.8 SD= 1.2

8%	26%	38%	15%	13%
1	2	3	4	5
Well Designed				Poorly Designed

N= 47 Mean= 3.0 SD=1.1

GRAPHICS- DISPLAY

5%	10%	8%	2%	3%	72%
1	2	3	4	5	___
Valuable				Useless	Cannot Say

N= 158 Mean= 2.6 SD= 1.2

16%	24%	28%	18%	14%
1	2	3	4	5
Well Designed				Poorly Designed

N= 50 Mean= 2.9 SD= 1.3

Questionnaire for Students who Dropped Course
Virtual Classroom Project

Course Name:________________________________
Course Number and Section:_______________
Instructor:_________________________________
Student ID Number:__________________________

SCHOOL X=1.00 SD=0.00 N=9
I am:
(1) 100% An NJIT Student.
(2) 0% Upsala Student.
(3) 0% New School (Connect-Ed) Student.
(4) 0% Other ____________________________.

How important were each of the following factors in your decision to drop the course?

Reason	Very Important	Somewhat Important	Not Important	X	SD	N
DHEALTH Health problems or personal problems	22%		78%	2.56	0.88	9
DHARD The course was too hard for me	11%		89%	2.78	0.67	9
DWORK The course was too much work		11%	89%	2.89	0.33	9
DINSTR I did not like the instructor	22%	22%	56%	2.33	0.87	9
DBORING The subject matter was boring or irrelevant	22%		78%	2.56	0.88	9
DDROP I had too many other courses and needed to drop one (or more)	22%		78%	2.56	0.88	9
DPOOR I was doing poorly	11%	11%	78%	2.67	0.71	9
DNOLIKE I did not like the "virtual classroom" approach	22%	11%	67%	2.44	0.88	9
DDEMAND I had too many outside demands (other classes, full-time work)	33%		67%	2.33	1.00	9

DMATCH X=2.44 SD=1.42 N=9

The course did not match my expectations:

33%	22%	22%	11%	11%
1	2	3	4	5
Strongly Agree	Agree	Don't Know	Disagree	Strongly Disagree

DTRANS X=1.56 SD=0.53 N=9

I transferred to another section of the same course	44% Yes
	56% No

DAGAIN X=3.44 SD=1.59 N=9

If I had the opportunity, I would register for another class which **used the "Virtual Classroom" approach:**

11%	22%	22%	0%	44%
1	2	3	4	5
Strongly Agree	Agree	Don't Know	Disagree	Strongly Disagree

DMOST X=2.62 SD=1.60 N=8

(1) 38% CONFLICTED
(2) 12% SIMILAR CLASS
(3) 12% FAMILY PROBLEMS
(4) 25% TOO HARD
(5) 12% DISLIKE INSTRUCTOR

DBEST X=2.75 SD=0.50 N=4

What did you like best about the virtual classroom approach?
(1) 25% IDEOLOGY OF SYSTEM
(2) 75% CONVENIENCE

DWORST X=3.00 SD=1.41 N=6

What did you DISLIKE the most about the virtual classroom as it was **implemented in your course?**
(1) 17% LESS TERMINALS
(2) 17% SYSTEM TOO HARD
(3) 33% HINDERED DISCUSSION
(4) 17% ASSIGNMENTS HARD
(5) 17% DISLIKE INSTRUCTOR

ANY ADDITIONAL COMMENTS?

THANK YOU VERY MUCH FOR COMPLETING AND
RETURNING THIS QUESTIONNAIRE TO:
(USING THE ENCLOSED POSTAGE PAID ENVELOPE)

Ellen Schreihofer
CCCC @ NJIT
323 King Blvd.
Newark, NJ 07102

Guide for Personal Interview With Students

Interviewee____________________ Date_________

Interviewer____________________

Introduction: Hello, my name is XX and I am working as (job title) in the virtual classroom project.

What I would like to do is ask you some questions that will give us a deeper insight into your own personal experiences and reactions to the online course you participated in than we are able to get from the standard questionnaire. [If still online...] Then I would like to watch you for a little while while you sign online, and tell me what you are thinking as you interact with the system and the class.

We will share a summary of the comments by all the students in your class whom we interview with your instructor, but we will not identify any of the comments as coming from any particular student, ok?

1. Initial recruitment and feelings

How did you first hear about the virtual classroom project or the experimental online section in which you participated?

What were your initial feelings or reactions... what attracted you, what didn't sound good about this approach?

2. How about the initial training session... after it was over, did you feel that you would be able to sign online and find your class conference, or was there something than was not clear about what the procedure would be??

3. Where did you go to use the microcomputer equipment you needed to participate each week?

Were there any problems with the availability of facilities or with the lab assistant's ability to help you get online??
(probe)

Did you have any sort of regular schedule each week when you would sign online to participate, or how was it that you decided when to log on??

4. What were your initial feelings or impressions about the online class during the training and the first week? Can you

remember what you particularly liked, or what you didn't like or found confusing? (probe... anything else?)

5. What were your reactions to reading the comments or contributions by the other students... to what extent did you find this interesting or helpful, and to what extent did you feel this was a waste of time? Why?

Did you feel that you were part of a group or class working together, or did you feel that you were pretty much alone in learning the material?

(If felt part of group).. Did you or the instructor do anything in particular that helped you to be able to work and socialize with other students in the online class?

6. How about the lecture-type material presented by the instructor.. did you find it easier to understand the material in writing, or do you think you would have learned it better if you had listened to it in spoken form? Why??

7. Did you ever look at or join any of the public conferences on EIES, besides your class conference?

If yes... which ones, and what did you think of them?
If no... why not??

Did you ever exchange messages with anybody online who was not in your class or connected to the project?

If yes... how did this happen?

How did you feel about this experience of communicating with "strangers?"

8. How would you describe your relationship to your instructor online.. do you feel MORE or LESS able to communicate and relate to your teacher? Why?

Q 9 varies depending on whether interview
is with current student or fall student

9. [This question for fall students-- look first at their open-ended questions]

On the questionnaire you completed, you said that the things you liked best were[read quote]. Could you expand on that??

You also said that the things you liked least about the virtual classroom approach were [read quote]. Looking back, do you have anything to add to that?

[This question version for current students]

Have you developed any particular routines or tricks of the trade that that are making EIES more valuable to you than it was at first?

At this point in your online course, what do you like best about the virtual classroom approach... that is, what is good about it compared to a course given in the traditional classroom? [probe... anything else?]

What do you currently like least, or feel are the greatest problems or shortcomings about this mode of course delivery?

10. What advice would you give a student who is thinking of signing up for an online course?

How about your instructor... what advice would you give about how they could be more effective if they try teaching this course online again?

11. Is there anything else you would like to tell us about your experiences... anything that was especially funny, or memorable, or valuable, or unpleasant about your experience?

Interview 1
Face-to-Face Interview with a Positive Math 305 Student
Roxanne Hiltz, March 26, 1987

Q- How did you first hear about the project?

R- The reason I took it was it was the only section I could get into. It said "taught via computer" and I did not know what that meant. It fit in my schedule and I had to take something. I had never heard about it before-- did not know what it was about until we got to class the first day. I was real intrigued by it. I like computers a lot. I've had a lot of fun with EIES.

Q- What's fun about it?

A- I don't want to sound bad about the course, but the fun part I've had is in the "murder 1" conference. That was fun checking it out everyday, seeing what the group responses were. And the same with the statistics class. Before we started going to +quiz and +branch, everything was a conference comment. You could see what people said, like what they liked and what they didn't like... They were putting jokes in there...
I was trying to think how to describe it when you sent me that message. It's DIFFERENT. It's nice to have a class taught a different way than everyone sitting in front of the teacher. And the teacher goes on and writes, and you write it down...and you take the test and hand your homework in.. I do think I miss it though because she seems like she'd be GREAT teaching in front of a class. I've heard other people who have taken it with her there in the class, they say she is a great teacher, doesn't bore you or overwhelm you with work. She's kind and friendly and everything.

Q- Does any of her personality come through online?

R- Yes. she'll put a message in and say, "Have a great week," or "Hope your spring break is real nice." Especially, if you have a message or a problem, she'll write back, and say, "Hi there, how have you been? You have a problem with this...." It's really almost like talking on the phone. I try to send messages back the same way, real casual. It's not a strict teacher-student kind of thing. Because of her, you feel a lot closer, because it's so easy just to pop a question. She'll answer the next day, or whenever you come online.

Q- You still feel you have a relationship, though you hardly ever see her?

R- Yes. Also, I won't use the guy's name, but the first class, there was this jerk in the back, I said thank God we will not meet in this class with him anymore. In a way it's good, I can avoid him...

Q- In the beginning it was all comments, trying to get the students comfortable with the system and with each other. You're saying you were a bit disappointed when it got down to business?

R- In a way, because you miss participating in a class. But I do like the idea, I really do. Like the fact that some people could take the class from say, Chicago or California...

Q- The initial training session... basically, for your class, we did not have the right space for it.

R- yeah, there was a lot of doubling up. I was lucky, I got there early and got a terminal. There was a guy who stood next to me, and I see him all the time now. We go over the assignments, or we yell across the Center, "Hey, did you get the homework?" So I run over there and get on the system and get it printed out...

Q- That's interesting, that you do talk occasionally to other students in the class.

R. Um-humm. And of course you run into them every once in awhile in 306. It's good for me because it's my first semester here. It's almost as easy as meeting somebody in [a regular] class. You say, "Hey, I had a problem with number 2, I'll trade with you for number 1." For the first half of the semester I was having a problem doing all of it myself, and there's always some people to trade with.

Q- I'm glad to hear that students still have relationships and work on things together... You normally go to 306, you don't have a microcomputer?

R- I have one at home but I don't have a modem.

Q- How often do you go?

R- I normally go every day. Except Wednesday, I don't have classes then, and it's a long drive. But I go every day about 10am, quarter after 10. Print out whatever is on there.

Q- About how long are your sessions?

R- Half hour. But that's because I don't sit there and read off the computer. I think you'd go blind after awhile! I have it printed out and then take it home. Then work out problems and come back in the day it's due or the day before. I usually go through it once, read the people's comments and things... I just read them once and don't take them home. Then I figure out the lessons and whatever and print them out. Then when I come in, I just have to log on and put the assignments in. So I'm not on as much as somebody who just sits there online and reads it all. But it's really better, because for the final or something, what are they going to do, read them all again?

Q- Has there been any problem with having enough printers in 306?

R- There's only one that works. The AT&T doesn't have a tractor feed and it jams. You just have to time it right, and get there when someone isn't on it.

Q- Are there any other routines or ways of using the system that you have developed that work well for you?

R- Not really, because that's really all that I do.

Q- How do you find the workload compared to other courses?

R- It's a lot easier, but that's because my other courses, it's really wild. This other course, 90% of my time is that course, I have to study it all the time, fight my way through it. It's like 2- and a half hours a week I spend online, then at home, I have to read over the stuff and work on the problems. I use a marker on the printouts, and go through the book the same way. The total time is about five hours a week. But before a quiz it's more. Though in essence it's an open book quiz, because you have a time limit, if you don't know where to find it, it would take more than half an hour to do it.

Q- Are there any topics in the course where you found it really hard to understand from the combination of what's on line and what's in the book?

R- Yeah, at the beginning, with the different kinds of probability theory, subjective, a priori, all those...

Q- so, it wasn't the mathematical part, it was the theoretical or philosophical part?

R. um-humm. I'm not very good at philosophy. The math part, you have what she teaches online and the book and between the two you can figure it out.

Q- What are your general reactions to reading comments by other students?

R- They're entertaining. Some of those people have some witty comments. That makes the class more interesting. If you find that there are a lot of comments, then you get online just to see them. I've joined in there and provided a little wit here and there. It adds levity, you know, if everything is all is all bare bones and cut and dry, you're not interested, you don't want to study that much, you only care about your grade. This way, it adds interest to it.

Q- Do you feel more or less free to say something witty in a conference than you would in a class?

R- Probably more free. Because, I may seem gregarious, but I'm pretty shy. It's easier from here. Because it seems like one-on-one.

Q- Do you learn things from the comments of others, or is it more the sociable interest?

R- I think it's more the sociable, in the comments. But we don't have the comments now, we have the branches.

Q- How did you get into the murder 1 experiments... how and when and where did you find other things online?

R- When you first get online, they have an EIES headline. It turned out that I was spending a LOT of time at it. There are other things on there, but |I,m going to stay away from them the rest of the semester.

Q- Do you now exchange messages with anybody you met in Murder 1? Or communicate with anybody on the system who's not in your class?

R- Now, I don't. At the end of Murder1, we were trying to find out where we were all from. One guy's in California, Jill's in Texas, somebody in Woodbridge. We all said, wouldn't it be great if we could get together? But aside from class, I haven't gotten together with anybody else on EIES.
I'm wondering- will I still have that number after this semester?

Interviewer-- Yes, everybody is given the option of keeping their number, but it drops to a class two account, which gives poor response during busy hours.

R- Yeah, I'd be curious to. You run into people and you find out they are on EIES, And you say, "allright, I'll send you a message." Like, what are you doing on Friday? That would happen in any class.

Q- You mentioned about quiz and branch. Would you talk about your feelings about those procedures?

R- Plusses- it's a lot harder to cheat. You can't look at conference comments and see what everybody else did. Especially when we did a couple that were actual problems, you wouldn't have to study if they were regular comments. I can see the reason for them. And I like the idea with Branch that you can find out what other people's answers are once you put your answer in. I do know people who have abused it.

Q- How do you abuse it?

R- You do it with somebody else. And find out the answers. I've seen that done. But it's better that you do it alone. As far as I'm concerned, I'm here to learn. Some people are just after grades. There's one guy in a couple of my classes who cheats left and right.

Q- He cheats in all classes? And found a way to do it this way too?

R- Right. If you want to cheat, you can. You find out who those people are. And when they ask, you say, "Oh, no, I didn't do the homework either," you don't give it to them. Because you don't get anything back from them. If it's a two way street, I don't consider that cheating. I'm not going to say names, but there is one person who does not reciprocate, and no one is helping him. No one talks to him in class.

Q- This is in the online class?

R- Both.

Q- In the beginning, the things that you mentioned that were good were that it fit around your schedule, and it's different and therefore interesting. Anything else you can think of as an advantage?

R- Related to the fact that when I signed up for it it was listed as Wednesday and Friday, but since it's my only class on Wednesday, I don't have to come to school on Wednesday, and I can take it whenever... I can take the quiz anytime before Thursday. I find it very flexible that way. I can come in between classes and do it. So you can "front load" it all in the beginning of the week, or wait till the end if something else has come up. That's what's good about it.

Q- What about the greatest problems or shortcomings?

R- That immediate answer to a problem which you will get in a class. Where you raise your hand in class and the teacher answers. A lot of times, even if Rose is on, I send the question and sign off, because it might be 10 or 15 minutes until she answers. So I'll get it the next day. Aside from that, I don't see any problems with it.

Q- What kind of advice would you give a student who sees this on a schedule?

R- I'd say take it, especially if you have not had any computer experience. Anybody in their right mind knows that somebody who has not had any computer experience will be passed by in jobs by somebody who does.

Q- What you saying is, take it, because besides learning statistics, you are going to learn something about computers?

R- That's one reason. The other is the flexibility. You can learn as much as if she were teaching it face to face.

Q- Do you have any questions for me about the project?

R- Are there plans to have other courses? I think there are 2 or 3 now?

Q- Right now we don't necessarily have funding for next year. We hope to get enough hardware at NJIT so that regularly, there might be say half a dozen courses that have online sections.

R- I'd like to take other courses. There are obviously things it would be hard to apply to- say a mechanics course on structures- but English

Interviewer-- Yes, we had an English course online. And CIS seems to work well.

R- Yes, that would. But unfortunately, I took 213 already. I'd like to take another course.

[end of interview chat and thanks edited out]

Interview 2
TELEPHONE INTERVIEW WITH NEGATIVE MATH 305 STUDENT
George Baldwin, 7/2/87

Q: Do you remember what it was like when you first came into the program? That is, when they told you it was to be offered "online" how did you feel?

A: I didn't like it!

Q: Did it come as a surprise to you?

A: Yes

Q: Did they offer you an alternative?

A: Yes, a night class. And that didn't fit my schedule.

Q: So, did you feel that they were not being straightforward with you about how the class was to be offered?

A: Well, it wasn't in the registration material, if that's what you mean. Maybe it was, but I just missed it.

Q: They gave you a training session. How did you feel about the training conference?

A: Just fine. There were plenty of people to help.

Q: Where did you usually use the computer to get online?

A: At my home. I have a computer at home.

Q: Then would you say that it was convenient for you to do your work?

A: Once I got a modem, yeh!

Q: Did they explain to you how to plug the modem into your computer?

A: I already knew how to do that. I usually signed on when I got home at night.

A: Since you were signing on from home, there weren't any lab assistants available to you. Did you have any problems in not having help?

A: I could usually hack my way around!

Q: Did you have a regular schedule that you followed each week in signing on for class?

A: No....That was one of my biggest problems...I know you're going to ask that. Personally, I usually try not to take self-study classes. And that's pretty much what that is. I don't feel that I have the self discipline for it. I don't have enough time in my day as it is. To sit down and make myself do something like that.....Self study takes a certain kind of person to do that. And I'm not that kind of person.

Q: The first week that you signed on to the system...can you remember what your first impressions of the system were?

A: It didn't bother me to take a class online like that. I am not scared of computers. I just don't like self study. I don't have complaints about the class.

Q: When you did go online with the other students, how did you feel about the comments and contributions of the other class members? Were they of any use to you, or did you find them to be just a waste of time?

A: I usually just blew-off the other class members comments and went straight to the professors lectures. I wouldn't say that the other students comments were a waste of my time, I just didn't read them!

Q: Did you feel like you were part of a group, or were you pretty much alone in learning the material?

A: Pretty much alone....but I feel that way about my other classes as well. I have two other friends that I sometimes study with, but that's about it.

Q: Did the instructor do anything that you found helpful in doing your work?

A: She was very helpful. She gave us her home phone number and we were able to call her at the office....voice or online.

Q: Did you ever ask her for help online?

A: No, usually I went to see her at her office.

Q: How did you feel about the lecture material presented by your instructor? That is, did you like getting the lectures in written form online or would you have preferred a real-time voice lecture?

A: I would have rather had it in a regular lecture type classroom. I don't really LIKE sitting in a classroom, but I find it easier for me. It works better. If you have a question you can just stop and ask right then and there.

Q: While you were doing your online class, did you ever join any other public conferences?

A: No.

Q: Why?

A: I worked full time and went to school full time. Busy. It's kinda tough. I'd usually go to work...then to school,...then to work and then back to the house to study at 11 at night, and I didn't want to sit down and read some other stuff.

Q: How about private messages? Did you private message any of the other people in your class?

A: Yes.

Q: How often, and why?

A: Sometimes to ask them a question about something-or-another. Some of the time with the T A...who was there to help. I send her messages sometimes.

Q: How about people outside of the class? Did you ever send them private messages?

A: No, I didn't know anyone outside of the class. I really don't think that I used the system as well as I could have. But I think that's because I didn't have any time.

Q: The relationship that you had with your teacher-- Did you feel more or less able to communicate with the professor through the computer?

A: Less

Q: You mentioned that you liked to go to her office and talk with her..

A: Yes, more personal.

Q: You wrote on your questionnaire that you felt that the EIES system was impersonal. That's one of the things I'd like to talk about. Could you tell me why you thought it was impersonal?

A: Because you had a computer in front of you...instead of a person. Like I said before, if I have a question in class I can just stick my hand up. You can't do that on a computer. You just have that text in front of you. You know how it is...sometimes you can sidetrack the professor. Get'em to bull shit for a while...you can't do that on a computer.

Q: What was the best thing about the EIES system?

A: I could sit down and do my work at any time.

Q: And the worst thing?

A: That it was self study. If it came down to taking another self-study class like that again,'I'd really have to think long and hard about it. I usually try not to.

Q: If you had a friend or another student who asked you for your advice about taking an online class, what would you tell them?

A: I'd tell them what it was like, then say "It's up to you as to whether you can do it or not." It's self study.

Q: If you were talking with a professor who was thinking about teaching an online class, what advice would you give the prof?

A: I'd tell 'em that you have to make yourself available. You really do. Personal interaction.

Q: Not just online?

A: Yeh. You don't have to have millions of office hours, but you gotta make yourself a little bit more available. Just in case there is a problem...you just can't settle it over a computer.

*****

[Note: Besides regular office hours, the instructor made herself available in the Lab for two hours every Thursday, specifically to help online students with any difficulties. This student shows no recognition of these opportunities.]

Interview 3
INTERVIEW WITH MODERATELY POSITIVE CC140Y STUDENT
Roxanne Hiltz, April 10, 1987

Note: the student responded to a message requesting volunteers for interviews. She is one of the better students in the course.

Key: I or Q = Remark or question from Roxanne Hiltz, Interviewer

R = response from student

Q- How did you first hear about the experimental means of delivery for this course?

R- In the class, the first day. I had no idea before then.

Q- What were your impressions that first day?

R- "Oh, No!.." (laughs...) "What are we getting into... this is something new!"

Q. Did you consider transferring to another section at that point?

R- No, not me. (Q- why not?) R- Because I knew that every new thing, in the beginning it's hard, but then you get used to it.

Q- So, to you it was sort of a challenge?

R- Yes.

Q. Do you have any thoughts about those first couple of sessions, any ways they should have been done better?

R- The handouts were very good. I used them later on. In the first session, I was really confused, I did not know what was going on. It was pretty crowded; hard to listen and hard to know what was going on. I paid attention but it did not help too much. I think it would be better in a classroom. Put it on the board and go over the handouts.

Q- One idea would be to start in the lab; do a very brief demo, saying "here is the system you are going to use;" move to a classroom and explain it on the board, referring to the handouts...

R- Yes, and then go back to the lab afterwards. Some people may not have used the handouts.

Interviewer... maybe that is why they had so much trouble...

R- I think it is better if the teacher himself give the lecture. Show about the conference, where to put messages..

Q- Try to compare this to courses you have had in the traditional classroom... what do you like, what don't you like, what problems you have had...

R- What's good is that you don't have to be in class. But that's a problem, too. I'll say, ' I have time, till Wednesday,' then once you start to read everything you find out you have to read it at least twice. You sometimes don't do your homework really well, because it is a last-moment exercise before you know it." If you have class every two days, you know you have to be prepared. So, it's good and bad... you have the time, but you have to know how to make good use of it.
Another problem is, sometimes you don't feel comfortable asking the teacher questions through the computer. In class, you can raise your hand, or you can ask questions after class. It is not as comfortable to ask a question online, so you don't ask.

Probe- what makes you feel less comfortable?

R- maybe he will take off credits or something. Sometimes it is too late to put a question in (the assignment is already due). It's more personal when you see the teacher.

Q- Do you ever work at all with other students in the class?

R- Not really working, but sometimes people ask questions.

Q- How could things be improved so that there is more communication with the teacher and the other students?

R- With the teacher, the communication was good. It was just the part about asking questions about the material. The idea of quizzes- probably nobody will like it, but I think it was a good idea. It will force you to sit down an do your homework. You have to do it on time, which is very good. He should start this from the beginning. What has happened is, now I got my new assignments, and so many things were put at the last moment. He should put more in the beginning, to divide it better so all the pressure does not come at the end.
How to improve... hmm... it's cute idea to use it; I like it. Maybe a few more examples would help.
Maybe he should direct, "this student and this student, you have to do this assignment together, through the computer."

Q- Ok...one of the things we wanted to do was somehow getting the students doing something together online.

R- From the beginning to the end, this could be done, but the partners could be changed for different assignments.

Q- How would you feel about being assigned a partner?

R- No problem. Like (name) and I, we write each other messages all the time about questions. But nobody else asks me questions other than (X). So, you could change partners, and sometimes have a group assignment. Then, you do have to depend on your partner; and if he doesn't do his part in the end...

Q- Yes, that is one problem, assigning grades when the partners do not work equally. That's a good idea, though.

Q- Do you think that the freshman or sophomore level is good for this sort of course delivery, or should it be only for upper level courses?

R- If you want to study, you study; it does not matter if you are a Freshman or a Junior or a Senior. It's a challenge.

Q- Is there anything else you particularly liked about this mode of delivery, other than not having to go to class?

R- Yes, i like having the complete lecture. You can get it and then read it three days later; or you can go in in the middle of the night. It was easier for me.

Q- Some of the students have not been very active in the class at all. Have any of them said anything to you about why this is?

R- Probably because they don't have the time. They postpone it until the last minute, and then the last minute it is too late to do everything.

Interview 4

INFORMAL INTERVIEW AND OBSERVATIONS OF NEGATIVE CC140Y STUDENT

Roxanne Hiltz, March 26, 1987

While in my office at Upsala, a disgruntled virtual classroom student appeared. He was very impatient about being helped by a lab assistant. I first observed him exiting the Lab, muttering epithets, and asked if I could help him. He complained that he "had to use the computer now," and that the lab assistant had asked him to wait a few minutes while she finished helping another student. He claimed that he had only a few minutes to "get the stuff."

This student is very unhappy with the online section and with the course, which is computer-assisted statistics, required for freshmen as the second half of a sequence of courses which introduces them to computer usage. He said he wanted to transfer to a different section; but, he could not take any other sections scheduled because they conflict with his other obligations. Moreover, he does not like computers and does not want to have anything to do with them.

The student is very negative towards any interaction with other students, or anything beyond the minimum necessary to get through this required course. In the first assignment, where he was instructed to enter a conference comment answering a survey, so that the students could use each other's answers to compute some statistics on the data, he had been instructed to use the key "survey." He added the key, "junk." He feels that all of the material students are entering is "junk."

I helped him print all his waiting conference comments, about 26 at this point. When I came back, I noted that he had ripped off the ones entered by the instructor, but left behind as unwanted comments entered by other students. He had not signed on to enter anything himself. He had not entered anything himself, just ripped off what he wanted and left.

Interview 5
TELEPHONE INTERVIEW WITH NEGATIVE CC140 STUDENT
George Baldwin, 6/30/87

In the follow up questionnaire, this student indicated that she did not like the EIES classroom approach. By her own admission she also did not do well with her final grade. She DID like the instructor. Text of the interview follows.

Q- Do you have time to talk with me about your experiences with your online EIES computer class?
A- I have time but I didn't do well in the class!
Q- Oh, that's okay. I just want to find out about your experience with the class.
A- Oh, okay!
Q- Great. Do you remember what it was like the first time you used the terminal to go to class?
A- I thought it was interesting.
Q- You weren't intimidated by the machine or the computer at all?
A- Oh, no. Because before I had taken Stats I had had computers.
Q- Then you had used computers before. How did you feel about the course being taught online-- could you give me your impressions about how you felt when you heard that the course would be offered online?
A- I didn't understand it at first. I thought that, it , well, I didn't really know what it meant. I didn't know what "online" meant until I got there.
Q- They gave you some training before you went online. Do you remember what the training was like and how you felt about it?
A- Well, there were two training sessions and they were 2 hours each and they went over all the commands and how to hook up to EIES and the phone numbers.
Q- Did you feel confident in signing on, and getting into your class conference?
A- Well, it took me about a week more before I could sign on and get on by myself. They had people there to help me in the beginning, but then I started picking up on my own.
Q- Where did you go to get online? That is, where did you use a computer for signing onto your class conference?
A- At my college-- at Upsala.
Q- You didn't have any problems of access to a computer?
A- Well, no. Sometimes they were busy, but I usually didn't have to wait too long....about 5 minutes.
Q- Did you have problems in getting help from a lab assistant?
A- No. They were the ones who helped me get online in the beginning and then I picked it up. And they helped me print it out.
Q- How often do you recall signing on each week?
A- My course was only six weeks: In the beginning I didn't sign on at all because I was sick. Then I started going three times a week. Same as my other classes.
Q- Oh, then you had a regular time for signing on?
A- Yes. About 10:00. It fit into my other classes.
Q- If you had a computer at home, would you have signed on from there or still gone to school?
A- I probably would have blown off the one at school...after I had learned to sign on at the lab....maybe getting my assignments at school, but doing my work at home.

Q- Can you remember the first week you signed on? Can you remember what you particularly liked or disliked about the EIES system?

A- Well, I thought it was pretty easy to understand. I mean, the computer told you everything to do! The only thing that I had trouble with was like trying to get to the scratchpad...because like in the beginning you had to hit break and all that.

Q- Did you have problems with the scratchpad editor?

A- No, not at all.

Q- When other students made entries, and you read them...how did you find their comments: useful, interesting, or a waste of time?

A- Well, most of the students who made comments were the ones who really understood the class and they were about the lectures. And they were pretty helpful, especially when the homework could be checked.

Q- Did you make very many comments yourself?

A- No.

A- You had to send conferences to your teacher, but I didn't say much.

Q- Well tell me: Did you feel that you were a part of a class, or did you feel alone in your studies?

A- Well, we had a buddy system, and this other girl and I went together. I felt by myself, or with her.

Q- About the instructor. Was the instructor there to help you?

A- Yes.

Q- Your instructor presented lecture material online. Did you find it easier to understand it in writing, or would you have preferred to have had it in a verbal type lecture?

A- I liked it better in writing.

Q- Better than in a spoken form? Why was that?

A- Because I always find that when someone gives me something written I find it easier to comprehend it. Sometimes when people talk your mind wanders and you don't get it. But when it's written, its all there for you. When people talk they don't keep repeating themselves. This way I could just read it over and understand it.

Q- Do you think you keep good notes in class?

A- Sometimes, but like I say my mind wanders and you just try to pick it up but it's pretty hard. But otherwise I take decent notes.

Q- While you were on EIES, did you try any of the public conferences besides the one for your class?

A- Well, my girlfriend was in a French class and she connected with some- one from NJIT and they conversed back and forth. And I used to read some of her stuff about what they would say to each other.

Q- Why did you not join any of the other conferences? Were you short on time, or did you just not know about the public conferences?

A- I guess I just didn't know about them. The only conferences I read were the ones with my class.

Q- Did your teacher, or any instructors ever mention to you about the other public conferences?

A- Some lady did mention that you could get messages or conferences somewhere around the third week.

Q- Did you ever exchange messages with someone not in your class?

A- I never exchanged messages with someone not in my class, but I did with people in my class. Like when I got sick, I left messages for that girl I used to go with. She got it okay!

Q- Could you describe your relationship with your instructor for me? Were you able to communicate well with him?

A- Well, I did find it hard if I had a problem, because I was sick.

Q- I see...is that because you didn't have a terminal at home, or

A- Right. But he said he was always in his office, and everything.

Q- At this point, could you tell me about what you liked about the EIES Virtual classroom approach? What do you think was the best aspect of it?

A- I liked that I was indepenendent and that I could go whenever I wanted to. And I liked how the conferences were written down and I could get my notes. It also helps if you miss a day or two. Because the computer always has your assignments there for you.

Q- What did you like the least about it?

A- There wasn't anything that I didn't really like about it. I thought it was very well organized.

Q- If another student came up to you and said they were thinking about signing up for an online course, what kind of advice would you give that student?

A- Not to get sick! Unless they have a computer at home.

Q- I am thinking about teaching a course online. Speaking to me as a teacher, what advice would you give me about teaching an online course?

A- Well, the teacher that I had was very good. He left messages about what time he would be available for students, if you had any questions or problems. And in his lectures he would put the pages and the chapters. And you could read them along with his lectures if you didn't understand it.

Interview 6
INTERVIEW WITH SATISFIED OSS VC STUDENT
Roxanne Hiltz, March 29, 1987

Q- I want you to think back to when you first heard about how this course was going to be delivered... what were your impressions?

R- It was the first day of class. I liked it. I thought it was cool. I just like working with the computer. It seemed different... fun. It's turned out pretty good so far.

Q- What is it that it about it that is fun?

R- It lets up some of the class time. You're not pressured to have something done right away- you can do it whenever you want. You can be more free on the computer. Some kids are hesitant to speak up in class. You can put in your thoughts.. people read it. Sometimes they care, sometimes they don't. If they don't, they can just skip on by it. It's also good because there is easy access whenever you want. I have a modem at home. I can go on at 3 o'clock in the morning. That's usually when I do most of my work.

P- Do you do it all at home, or do you sometimes use the computers here?

R- I never use the school system. I heard a lot of kids have problems in the library. They leave messages like, "sorry, I can't read what I"m writing." I bought a modem specially for the class. I saw that it would be kind of useless to come down every day to use the school system. It works much better from home.

P- Anything else that you like about it?

R- I don't know. Dr. Hsu makes all the students participate. For instance, we have two businesses competing against each other, and separate conferences to compete. The more work you do and the better your profits, the better your grade. So that's pretty good. If you do the work, you get the grade. He does not base it so much on book learning. I can't learn it from a book. You learn it as you go along, you get ideas from everybody else, not what one author thinks.

P- Picking up on that- to what extent do you think it is either boring or interesting to read comments from the other students?

R- Dr. Hsu really doesn't say all that much. He leaves it almost entirely up to the kids. I think it's good. I'm learning so many things. We're not held tight to OS471. I've learned a lot, like people ask about jobs, and just general information giving. For instance, we have a chapter on informal and formal businesses, and he'll say, "What's your opinion?" Then you can read other people's opinions and let that help you form your opinion. You can go back and change your opinion if you want, which is good.

Q- Do you send private messages to anybody?

R- Yeah, I have a few people I send messages to. (gives names) (some are on staff).

P- so sometimes it's about the course, and sometimes it's not?

R- yeah, sometimes it's just goofing around.

Q- have you gotten involved in anything else going on on EIES?

R- Not really. I've played around a little. Nothing seemed to concern me to much. I was looking at INterests; I saw other people had them listed, but I couldn't figure it out. And the games. The reviews and surveys I haven't figured out how to work yet. But i got time.

Interviewer- survey, you should really stay out of... if you want to set up an online survey, it's pretty complicated.

Q- What about your relationship with Dr. Hsu? Does he seem the same online, or different online?

R- He's pretty much the same online. I think he's a really good teacher. I would recommend him highly. I think that course is much better with the online part. I think you'd be bored to death sitting there learning about business every time. The application is great. I'm glad that I have it. I'd take it again... I've already recommended it to my friends. I think it's just so much better. And Dr. Hsu, he's great. He's got a great personality, not a real strict or stingy type guy. For the most part he wants your opinion on things, and he'll conform to your opinion. In fact, he asked us how we want him to grade our tests. He leaves things up to us. He has a good sense of humor too.

Q- What about disadvantages? Do you think you're missing anything or are there things that annoy you about using the system?

R- Definitely disadvantages. Some people are lazy. I just can't afford to be lazy because that's what the teacher is grading you on. But online you don't have to log on if you don't want to. You're only hurting yourself.... No, you're hurting the others, too, because they aren't getting your opinion on things. I guess some of them are restricted to school use, and the computers here are down half the time anyway. You don't have to worry about keeping records because you can always call everything back up. I don't see too many disadvantages really. I've never had a problem with it.

Q- have you used branching?

R- yes

Q- what was your reaction to that?

R- I'm not crazy about it. It's kind of a hassle to put in, and then search through the branches. I see why he does it. But once you're in it, you see everything anyway, so what's the difference? You could just put it on the regular conference. It's for organization type purposes I guess. For instance, our resumes are all in a branch. I never went back once I put mine in, personally. So I don't see too great an advantage of it, except for organization.

Q- have you developed some sort of routine; ways of attacking the system once you sign on?

R- yeah, I always do the same thing. I always want to see who's online, in case any of my friends are online. Then, if there are any messages, I'll read them. Then I'll either answer the messages if there were any left for me; then I'll go to conference choice. I always do conference 1732 first; then the other one for the company. I read all the responses. I save everything to disk, so I just usually scroll it up. Then I'll go back and write comments. Then I goof around after that, and log off.

Q- How much time do you spend?

R- I sign on every day. I usually spend about an hour; it depends how much other work I have. Sometimes as little as half an hour; sometimes two or three hours. Sometimes I sign on several times a day. I spend a lot of time online. I love it.

Q- More than you spend on other courses?

R- yeah. This is my favorite course. I don't mind putting in the hours, the time just flies by.

Q- Suppose we were doing a brochure for prospective students. Are there any warnings we should give them? What kind of advice

would you give them?
R- If you do it from home, make sure you contact the telephone company first because you can run up a big phone bill if you don't get special services from them. I called about a week after I got my first phone bill. Now it just costs about $4.00 a month.
P- We did mention this the first class.. but you think we should be stronger about this.
R- yeah. I was running up 20 to 30 hours a month. (tape ran out here and fumble-fingers interviewer took awhile to get new one in)
Q- If you were going to add something to what's available, can you think of any features that you would like to have available?
R- Not now. I'll have to think about that. That's a tough one. I've never used any other system.
Q- anything you would like to anonymously tell Dr. Hsu?
R- He has a group read a chapter and put their outline on the system. i think it's a wast of time because no one is reading the chapters. Nobody asks questions in class because nobody's rading the chapters. When it came time for the midterm, we were all complaining. Plus his two points for every right answer and two points off for every wrong one- it's different. That didn't go over too well. I like the way he presents his material. Sometimes he puts a comment in and says you have until that night to do ot- who has free time like that? I'm not too crazy about that. But I guess he has to do it that way and it's our fault for not getting it on.
Q- Can you think of anything else that was especially memorable, or funny?
R- On the system. Sure, when we were all first trying to learn it, sending messages to each other, some of them were going to the wrong people. Someone in class got an anonymous message This guy Stacey got a message from "an admirer," and it was anonymous. And no one wanted to claim it.
P- I see. The man's name was Stacy; so it could be a woman's name? Somebody sent it to him and looked again- and oops!
R- Yes. he left a note on the conference saying, thanks, to whoever sent him the message, and he hopes he gets another one. No one has since written a message. Then the teacher, Dr. Hsu, put on a question, "what's your opinion on anonymous messages?" That was pretty funny. And his making it an assignment, that was good. He does that a lot, asking your personal opionion on everything. That was pretty funny.
Q- Do you have anything you want to know about the project or the system?
R- what's coming now? I know there's going to be a new EIES? (interviewer explains 2 new systems and prototypes) We hope eventually to put up a utility and to offer a number of courses this way.
R- So you wouldn't have to come to class at all? I think that would really be something to try to see how it works. I would do that. interviwer- most of the courses online now are totally online.
R- Oh, are they? I didn't know that.
Interviewer- they come to their training, and then don't meet again until the final exam.
R- Yeah, we tried to coax our teacher to give us an online midterm. He would't go for that. We asked if we could have a virtual midterm, and he said, "How would you like a virtual grade?"
Interviewer- The problem is that it is possible to cheat.

R- he mentioned that you were thinking of having a time limit and you couldn't log off until it's done. that's a pretty good solution. Of course it's still possible to cheat, unless you make it explicitly an open-book, open-notes exam. (Interviewer explains that 213 and NJIT statistics course are totally online this semester).
R- too bad i had 213 already.
Q- Anything else you can think of?
R- Yeah, what courses are you going to be putting online?
Interviewer- I don't know. Right now we don't have a mainframe to regularly run on.
R- what about keeping our account?
Interviewer explains...
R- that's good.
(more irrelevant chat about future plans)
Thanks a lot for stopping by.

Interview 7
Telephone Interview with VC Dropout Not Responding to Questionnaire
Conducted by George Baldwin
Class: OS471-Management Lab- NJIT

Q: (first name), I am doing a follow-up study on students who dropped out of the virtual classroom project. (Name), you did a management lab with us here at NJIT. Would you mind talking with me a few moments about why you dropped the course? It's kind of important to us.

A: I don't have time to get down there, I'm on a tight schedule. I used to go to work right after class. I used to have to go there and put time in on that terminal. ....I was never able to do it.

Q: So basically it was coming over to NJIT to use the terminal?

A: I would already be at NJIT. I, like I said, run a tight schedule. After my classes, I scheduled so I could go right to work. And I don't have a modem at home.

Q: So do you think it would have been a little easier if you had a modem at home?

A: Yeh. And they didn't really go over the right procedures for getting a modem or getting an outside phone line to hook it up. They didn't go over that at all.

Q: So you would have appreciated it if.....

A: Yeh: I had to drop that class, and I wouldn't have had to take it over again during my senior summer which is what I am going to have to do now if I want to graduate in May.

Q: Oh.

A: I would have rather had taken a different course if I didn't have to take that one. I wouldn't have had to drop it. Thats the reason I dropped it. I couldn't do those stupid classrooms. I couldn't get the lab time in. Thats why I dropped the course.

Q: How did you feel about the Virtual Classroom approach?

A: Ah, I really couldn't, I really can't evaluate it. I wasn't in it long enough, ya know.

Q: Ok.

A: I only went to the first couple of EIES sessions. I never even got my thing, my resume into the class.

Q: How about the subject matter of the course? Was it boring or relevant to you? You mentioned that you would have rather had another class.

A: I would have rather taken another OS471 class without the computer because then I wouldn't have had to drop. And I would have had the course.

Q: Did you ever get to meet the instructor?

A: Ah, which one? My teacher?

Q: Yes. Did you like him?

A: Yeh, he's alright. Dr. Huang-- H-Z-U.

Q: So what you are going to do this summer is retake it? During your senior summer?

A: Well, I'm a senior now and I'll graduate with my class in May. I will need six credits to graduate. That's what I mean by my senior summer.

Q: Tell me (Name)...would you register for another class using the VC approach?

A: It depends. I can't answer that question.

Q: If you had a modem at home and a computer.......

A: If I had it already, yeh.

Q: Did you ever sign-on to the class? (Yeh) Is there anything that you particularly like about the VC approach.

A: Gee, its been so long...I liked the way you could send messages...How everyone was tied in together like that.

Q: Do you remember what it was like the first time you signed on to the system?

A: I didn't think it was any big deal.

Q: Had you used computers before?

A: Yeh! I have one at home!

Q: Do you recall anything that you particularly disliked about the VC approach, at least as it was used in the course that you were taking?

A: I really don't have an opinion, one way or the other. I only went to the classroom twice! At that point I was just running around and falling more and more behind in that class. And that's why I decided to drop it. I stopped going to it and I dropped it really late. It might look like I stayed in it longer than I did, but I stopped going because I realized that I didn't have the time for it. I dropped it at the end of the year.

Interview 8
Face-to-Face Interview with a Moderately Positive Student
Organizational Communication Course
April, 1987 Starr Roxanne Hiltz

Note: This student was not among the best in the course, either in terms of grade (B) or subjective ratings. However, the student did like the system well enough to request continuation of an account beyond the expiriation of the course.

Int: When you first heard that part of this course would occur online, in a "virtual classroom," what was your reaction?

R: I heard about it through the professor in the course. I didn't know what it was all about, what it would be, except that it would involve a computer... In the beginning, it was really hard, for some of the kids in the class. I myself adjusted ok.

Int: Where did you go to participate, and did you have any problems with equipment?

R: I went either at night, or right before or after class. See, our class was half online and half off. The problem I had was, there was a terminal in the library, but it did not work half of the time.

Int: How did you feel about reading the comments of other students? Did you find it valuable to read their opinions, or did you think that they were not worth reading?

R: I felt that they were really helpful. It gave me another perspective on what I was doing. If I did not see a point and they did, I was able to incorporate it into my thinking. As far as me responding, it gave me a chance to read what the other students wrote. Sometimes they responded and sometimes they didn't. It was a really good way of learning different ideas.

Int: When you were online communicating with your instructor (who happned to be me!), did you feel that you were more able or less able to communicate?

R: About the same. Except that it was especially good the time when you were away in Florida, this is the only way we could have communicated with you. If we had not had EIES, we could never have talked with you about the problems we were having with our work for the course. It was a good tool. Now, I still have an account, and if I need to get hold of one of my professors who has an account, then they will get it and respond. It is an easier way to get hold of a professor.

Int: When you were taking part of your course online, what things did you dislike the most, or find annoying? And on the other hand, what aspects of using the system did you find the most valuable?

R: Well, a lot of times online, things can be taken the wrong way. If you write a message and you do not put it in exactly the right way, somebody would get upset. It's not what you meant, but they took it the wrong way. Also, if you were in a hurry, you could not just sign on, quickly leave a message, and sign off again, because it was so slow. If I tried it in between classes, I would be late. Communicating one-to-one, face to face is quicker, but you can't always find the person. Also, I'm a commuter, and you can't make a trip to campus just to leave a message.

Int: So, your problems were basically with the mode of communication-- being careful lest you be misunderstood-- and with access and response. a few weeks ago. Something came off the wrong way. It's hard. You have to write everything "just so."

Int: There is something called "flaming" online, where people get upset, and because they cannot see one another, it can escalate.

R: Yes (laughs).

Int. You mentioned some problems. Is there any way in which this approach is better than face-to-face class meetings?

R: Well, if everybody signs on and gives a response, then everybody is able to read what everybody else is thinking. It's an easier way to get a class together. But I still prefer one-on-one. It's hard talking through a machine.

Int: If you were given a choice of a class totally online or totally face-to-face, then, you would take the face-to-face class?

R: I'd rather have it half and half. That way, you could have the experience of going online, but also be able to talk to the professor.

Int: Is there anything else you can think of in terms of things you learned from your experience?

R: I a lot about the computer, about conferencing... I learned a lot. Having the experience with telecommunications, it sparked something... I want to go into that. I don't know, I fell in love with the computer, even though it was hard sometimes.

Int: Could you explain about that? You said that it was harder, that it was colder, yet you say you "fell in love with the computer?"

R: I don't know, it's just that communicating like that, it's like talking on the telephone, only you're typing in. It's just amazing. It's colder but it's amazing at the same time, it's really interesting. I just like it a lot... it was wierd, here you were meeting people. You don't know them, but all of a sudden you get a message from them.

Int: So, other people sent you messages?

R: Yes, I never started it, but other people sent me messages, I guess because I was female. And I met a whole different group of people. People from Texas, from Florida, it's incredible.

Int: Your reactions were not totally typical. There were several students in the class who really disliked it. [R: I know, I know.] There were one or two who say they dropped the course because they could not stand the computer.

R: I can't believe that.

Int: Do you have any observations or interpretation related to this? Why their reactions were so negative, and whether anything could have been done?

R: People tend to be scared of the computer, and to get really frustrated. [When they have trouble, they say] Right away, "Oh my God! I don't know any of this! Why should I be bothered?" They just give up. I think if you stick with something, I think they would have learned to like it. Maybe if they had just tried harder, they would have liked it.

Int: Anything else you can remember about any problems?

R: Yes, with the microlab. With the lab assistants. Sometimes, they were there, but they were playing games or whatever. When you said, "I need help," they wouldn't move, or not quickly enough.

Int: So you're saying they were not actively helpful, they seemed to be preoccupied.

R: Yes, they were passive.

Int: Were there any assistants who were particularly good?

R: Yes, (name) and (name) were very good.

Int: What is it that (name) and (name) did that was good?

R: Well, (name) knew ALL the tricks, and he was there to help. If

you said, "I really need your help," he would get up and come over right away, and he knew what to do.
Int: So, its actively helping the students and being knowledgable, not just being there physically?
R: yes.
Int: Thank you very much [etc etc]

Interview 9

TELEPHONE INTERVIEW WITH A NEGATIVE CIS STUDENT

Starr Roxanne Hiltz, August 2, 1987

Q: How did you first hear about the virtual classroom project or the Online CIS 213 course?

R: I read about it in the registration material, and I decided I did not want to take it. Being a [non-CIS] major and going to school at night, I worked full time during the day, and I didn't know whether I would be able to dedicate enough time to it. What happened was, when I went to register, I registered for another course. And the registrar said there was a course open on Wednesday night, so I registered for it. The night the course was starting, that's when I found out it was the virtual classroom.

Q: I see, so you really got into it by accident...

R: He saw two CIS 213's, and he put me in the one that was open.

Q: What were your initial feelings at that point, when you got to the training and discovered what you were in?

R: I had a lot of apprehension. I mentioned it to the instructor, BJ, that I was kind of worried. I was ready to dedicate the time that I could to it, but I was still worried, because I thought there was a little extra that was needed. I think BJ mentioned that if there was any way he could help, he would do his best to assist. So I said, OK, how bad can it be? And besides, I really needed to take the course, and I wanted to take the course, and so I decided to stick with it. I was a little nervous. I really didn't want to take a virtual classroom course.

Q: Where did you go to use a microcomputer? Did you have equipment at home, or go to the Lab, or what?

R: That was the other problem. I felt that I was at a disadvantage because I did not have a personal computer. I really didn't have access to a computer except at work, and I had to compete against everyone else. There were like four for a department of 30 people, each running their own LOTUS or whatever; I had to fit myself between there. So I was forced to work after hours, 7-8 o'clock at night. Even that was a problem, because then I had to battle against the guys that were cleaning and waxing. I was at the point where I was getting frustrated because I was not able to work on it when I wanted to. The days when I really wanted to work on it were Saturdays and Sundays., I do a lot of my homework then. And the Institute was not open. I guess it was open, if you made an appointment or something you could get in for a few hours.

Q: So it would have been much easier for you if you could have gone somewhere on weekends.

R: Either that, or I was even looking for a good way to lease a personal computer. I went to a couple of places after the semester had started, and prices were just outrageous. To rent a computer for a month, it was like $400.00.

Q: Yes, that really is outrageous, they don't sell for a whole lot more than that!

R: I was really tight for money at that time. Under the circumstances, I just had to do the best I could.

Q: So, you work full time, and you would normally go in about one night a week?

R: That's about all I had. That's exactly what it worked out to be. I was able to dedicate one full night a week. That was like five or six hours a week. On the initial questionnaire, it asked about how much time you would spend, and I felt I was going to need at least two to three hours a day. If I had my own computer... but I didn't, I wasn't able to dedicate that much time. I think I did get a D in that course. I was hoping for something better, but under the circumstances, I think that a D was probably the most appropriate grade. I wish I had done better and I think I would have been able to.

Q: That long session one night a week, did you do it from work or did you go into NJIT?

R: From work, and I tried to get into NJIT a few times. When I did that, it was only to try to clean up the bugs on a program. It was more desperation, get-it-done kind of work, and I really was not picking up a whole lot of information...

Q: When you were out there, fighting for a computer at work, did you feel that you were part of a group or class, or did you feel really all alone out there.

R: That's a good question. I always knew that I was part of a group, but I also felt alone because I did not communicate like I really wanted to. There were some of the students who were on, sending messages two or three times a day. Those are the ones who communicated with each other. I even tried to do it, but with once a week, I didn't get a whole lot of practice with sending messages. For instance, I sent a few to [name], but it was difficult, because he had already progressed to a point where he could send messages all the time. I could send a regular message, but I didn't know about how to to the talking online... the ones who were doing that were the ones who were on two or three times a day. I couldn't devote that much time to it, and as a result, I didn't have that much communication. And as a result of that, I was more of an individual rather than part of a group.

Q: Did you read the comments by other students in the conference, or did you tend to skip over them?

R: My downfall was in trying to mimimize reading of the comments during the time I had to devote to it. I didn't read them on the screen, I printed them out and took them home. Then things would happen. I work long hours, I live alone and have to cook dinner... I did look at a few of them, but my downfall was that I tried to do everything as fast as I could in order to maximize what I could finish during that one night. I tried to bring the paperwork home, but you bring home a book and often it does not happen... I read maybe 60% of it. There were things that I would look for, like the lectures. Then I would make my own little notes on the print of the lectures.

Q: On the lectures, do you find it easier or harder to understand the material in writing, as compared to hearing it?

R: That was easy. They were clear and well put together... Sometimes I had some trouble associating the material in the lecture with what was in the book. If you didn't do that, and then tried to walk in and take the quiz.. it became more and more difficult.

Q: Did you ever send messages to BJ, or didn't you have time to do that?

R: I sent a few, but not nearly as much as I really wanted to. I think BJ noticed that right off the bat, he even mentioned that I was getting kind of quiet. I did send messages to him, things like whether I could get more time. We talked, but I don't think I got to be as close to him as I wanted to.

Q: Thinking about the relationship you had with BJ online, and the relationship you've had with professors whom you have seen one night a week, did you feel less able or more able to communicate with BJ? Did you feel closer or further away?

R: Definitely closer, but I wish I could have gotten as close as some of the other students seemed to be getting. That was one of the problems... looking at some of the comments other students were making, it was like, Wow! Look at the questions he's asking, and look at the comments he's getting back! Why am I not having thoughts like that?

Q: Well, because you were not there every day, right?

R: Exactly.

Q: If a student saw a course like this at registration and asked for your advice, what kind of advice would you give?

R: It would depend on the individual. I could not make a recommendation to a person I don't know. I could recommend it to someone who I know does have the time, and will dedicate the time and the effort, and who has the the equipment available at home to do it. I considered that probably the key to being successful in the class. Especially if the person needed the course, and would otherwise have to wait another semester; then I would recommend it.

Q: But only if they have the equipment, and if they are willing to work harder?

R: Well, I don't know if you have to work harder, but if you don't have the computer at home, you work 9 or 10 hours a day, then you have to go home and cook dinner... somebody like that, somebody in exactly the same circumstances that I had, I would have to think very, very hard about it. You want to get the most you can out of a course, and I don't think I did. I don't think it was BJ's fault, it was not having the right equipment to work with.

Q: What about BJ? What advice would you like to pass on to him if he were ever to do this again?

R: There were a couple of things... I don't know if I conveyed them in the questionnaire, when I filled it out it was like the night before the final, and I just wanted to get it done and study for the final. I wanted to do more "dinky" programs. I think we did two big programs that were assigned to us. I would have loved to have seen a tiny little program due every week, along with a couple of big ones. The practice would have been good, I would have become more familiar with it.

Int: Well, I really appreciate your taking the time to talk to me. I wish things had worked out better for you.

R: Believe it or not, I just bought another book on Pascal programming. I still want to learn. I'm still trying to pick it up, on my own. I felt bad when the course ended, and I really didn't pick up as much as I wanted to.

Interview 10

Telephone Interview with Positive CIS213 Student
Interviewer : Roxanne Hiltz- July 1987

I- Hi! (name). This is Roxanne.
R- Ok.
I- I am recording this. I will be anonymously using some quotes. What I found while going through the data from the survey is that they are kind of dry. So I'd like to ask you some questions so that I can get more of a feeling for what you really experienced. Ok?
R- Ok.
I- I want you first to think all the way back to last January when you first heard about the VC project for CIS213 online - What you heard, what your reactions were and why you decided to take it.
R- Ok. Lets see - I guess it was over the December vacation that I got it in the mail and I saw that they were offering CIS213 - (this is for me you know since I already knew Pascal) - I saw it was online and that I had a modem and everything, so I said "Easy A" - That's really why I wanted to take it. I knew pretty much about modems and all that stuff, and I said it should be pretty easy. You know you got to keep grades......
I- Okay. So you had a modem and Microcomputer right at home and access wasn't any problem for you?
R- Yeah! It was at school - I was on campus.
I- You were on campus. So it was like in your dorm room?
R- Yeah!
I- Did you have any technical difficulties at anytime?
R- Technical difficulties.... No. I didn't have any kind of difficulties.
I- Ok. When you actually got started what were your feelings at that point? What did you initially like? Dislike? Did you still think it was an easy "A" or were there some other things happening or what?
R- No. I still thought it was an easy "A". I thought the system was.... pretty good..... I don't know - I couldn't tell you how now - It could be better. It just seems it was pretty easy to get around - I didn't have any real problems - No major problems.
I- Did you have some sort of regular schedule each week when you were signed online or how and when did you decide to participate or take part?
R- Ahh! It was like whenever I had spare time.
R- You know I didn't log on just for the course - like when I wanted to download and once it was up I'd dump it in my buffer like 2 in the morning... or whenever I had the chance and I'd print it out next day.
I- So your normal thing was to download and then print and read it at your leisure?
R- Ahh..! Yeah! I'd read it first. But just to have a hard copy, you know for review and all that, it was a lot easier than going thru... you know...
I- The comments that other students made-- to what extent did you find that it was interesting or helpful or engaging to see some things from them - or to what extent did you think that what the other students said was a waste of time?

R- I'm not sure I understand you .... You said that some people said - "it was a waste of time"?

I- No! Some of the comments were entered by the instructor and some of the material was students making contributions, making comments or asking questions. Did you like to read the other students comments, or skip over them, or what was your reaction to things done by other students?

R- No, I thought, you know, it was helpful to have everybody participate - I didn't skip over - I read everything - just to see - you know, compare yourself to the rest of the class and know how they are doing and what they know and what they don't know and all that.

I- When you were out there at the end of your modem, did you feel that you were part of a class or a group that was working together, or did you feel you were kindda all alone?

R- No....Nah! I felt that I was computing a little bit. No! I thought I was in a classroom, you know.

I- Do you think that (instructor's name) did anything that was helpful to the class to become like a class that worked together, or on the other hand that he hindered that?

R- Did (instructor's name) ?

I- Is there anything that he did that helped the class to feel like a real group, or that got in the way of students feeling like it was a real class?

R-The Instructor tried to get everyone involved. He posted comments to encourage participation.

I- What about lecture type material? Comparing reading it to listening to it in a classroom. What do you see are the advantages/disadvantages?

R- May not want to be in class at the scheduled time - So it is better online. In addition, the lecture was only outlining major points covered. Advantages to both offline and online. For me it was easier in online lecture. The instructor made up the lecture personally, not as if he were copying it out of a book. Made it easy.

I- What about other people on EIES. Did you ever get involved in conferences or messages with people outside your class?

R- Yes, I joined a few public and private conferences and made friends that I still have now.

I- Wow! That is interesting. Are they friends in New Jersey?

R- Some people in my class and others - I even have my own conference now. Turbo pascal conference.

I- Oh! I didn't know that. So you went from student to conference moderator. How would you describe your relationship with (instructor's name)as an instructor? Did you feel more able or less able to relate to him as compared to teachers in a regular classroom?

R- Little more able to relate.

I- Why?

R- Because he doesn't see you - all he knows is what you type. He can't be prejudiced against you based on the way you look.

I- So you are saying he was more objective in this medium in reacting to the work you did and not to other things?

R- Yes! It's more fair this way. You're being judged really on your work, not on your personality.

I- Do you think you learned more/less or the same as you would have if you took this course in a regular classroom?

R- More for me - Learned the system - I already knew Pascal. Most people who take this course already know a little about computers.

I- So you're saying that you didn't necessarily learn more course material, but that you learned other things about other uses of computers?

R- Yes. If people aren't enthusiastic about computers - I don't know if they would learn more about it. They'd probably do less till they got the hang of it.

I- Why do you think they would probably do less?

R- Well! Most people are intimidated about it, wouldn't understand it - Its kindda like a hassle when you are first learning it, especially for those people who have not used computers since they were young like I did. So I got the hang of it quickly.

I- So, what you are saying is that the hardware/software didn't get in your way - it was like transparent to you.

R- For somebody else it might get in the way a little bit - added disadvantage to their learning.

I- Yes. Besides the fact that people who aren't familiar with computers would be slowed down while they got over the hurdle - Can you think of other problems or shortcomings in trying to use a Virtual Classroom approach to deliver courses?

R- For me? No! I didn't have any problems.

I- What if a student came up to you and said, I saw this thing - you took it - should I take it or not? What kind of advice would you give? What kinds of questions would you ask, to think about in trying to decide if the student should do this or a regular course?

R- I'd say definitely do it.

I- For everybody or just certain kinds of students?

R- Uhhh... I'd probably say for everybody - I'm not saying they'd get as good a grade - I'm just saying, do it for the experience and for fun.

I- Tell me about that. What was especially fun about it or more memorable - what made it different and fun?

R- I don't know - Just a change - Seems like more fun.

I- Do you think it was fun because it was the first time you did it - I mean if you took another course, would that be fun too, or would it not be as much fun?

R- I don't know - I've used a lot of computer systems, and for me it is just more convenient/interesting.

I- Okay. Is there anything else you can think about? It's been a little while but what could have been done differently or better? What should people know about in order to understand what it's like to take a course this way?

R- No! Not really.

I- Okay. Thank you. Goodnight.

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